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MATHEMATICS WE USE

BOOK ONE

BRUECKNER

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MATHEMATICS WE USE

BOOK ONE

by

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GRADE VII

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INTRODUCTION

Basic Plan of the Series. The basis of instruction throughout this series of textbooks is (1) the number system and (2) its social significance. Through carefully planned activities the pupil is taught to understand the nature of the number system. This understanding insures a meaningful grasp of the procedures that are presented in the various computational processes. At the same time the pupil is led to see the social significance of mathematics through the study of rich informational units of work dealing with everyday applications of number processes and quantitative procedures. Also, numerous activities are suggested which require pupils to investigate social applications of mathematics in their own communities. This plan insures a well integrated treatment of both phases of the subject.

Scientific Gradation of Subject Matter. To insure successful growth in mathematics ability, the authors have carefully considered the findings of important investigations of grade placement of the topics, and have made extensive surveys of their own, to determine the most satisfactory points at which to present the various elements of the work. As a result, the work of each grade has been considerably simplified and the teaching load greatly reduced. The easier phases of a topic,—for example, division,—are presented before the more difficult parts of the process are presented. Division with a one-figure divisor was first introduced in Grade 3, and in each succeeding grade some new phase of the topic was taught until this grade where division with a three-figure divisor is presented. This scientific gradation of subject matter insures easy and meaningful learning and eliminates the necessity of bunching a process in any one grade.

The major phases of the mathematics process taught in this book are as follows:

1. Division by a three-figure divisor.
2. Division by a decimal.
3. Finding a per cent of a number.
4. Finding what per cent one number is of another.
5. Finding areas of certain figures.
6. Beginning of informal geometry of shape.

Teaching Procedures That Insure Mastery and Understanding of Mathematics. These textbooks present an instructional programme that has been thoroughly tested in hundreds of schools. They provide a systematic step-by-step development of the fundamental operations in such a way that each step is both mathematically meaningful and socially significant. Illustrations, pictures, diagrams, and other kinds of visual aids are extensively used to help the pupils to get an insight into the mathematical meaning of the step being presented. Following this concrete development of a step, there are worked-out models for study and solution before practice on the new step is begun. The explanations of procedure are specific and detailed so that the difficulties learners sometimes encounter in the study of mathematics are reduced to a minimum. Diagnostic tests keyed to study helps and remedial practice are provided at frequent intervals to assist the teacher in locating pupils' need for additional instruction. These tests make it possible for the teacher to provide effectively for individual differences. They also insure intelligent co-operation by the learner toward the correction of any difficulties he may encounter. The skills that have been taught are frequently reintroduced in the units problem material to insure proper maintenance. Frequent mixed drills of a cumulative nature are also provided. The problems illustrating the applications of the processes are stated in simple language that pupils understand.

ACKNOWLEDGMENTS

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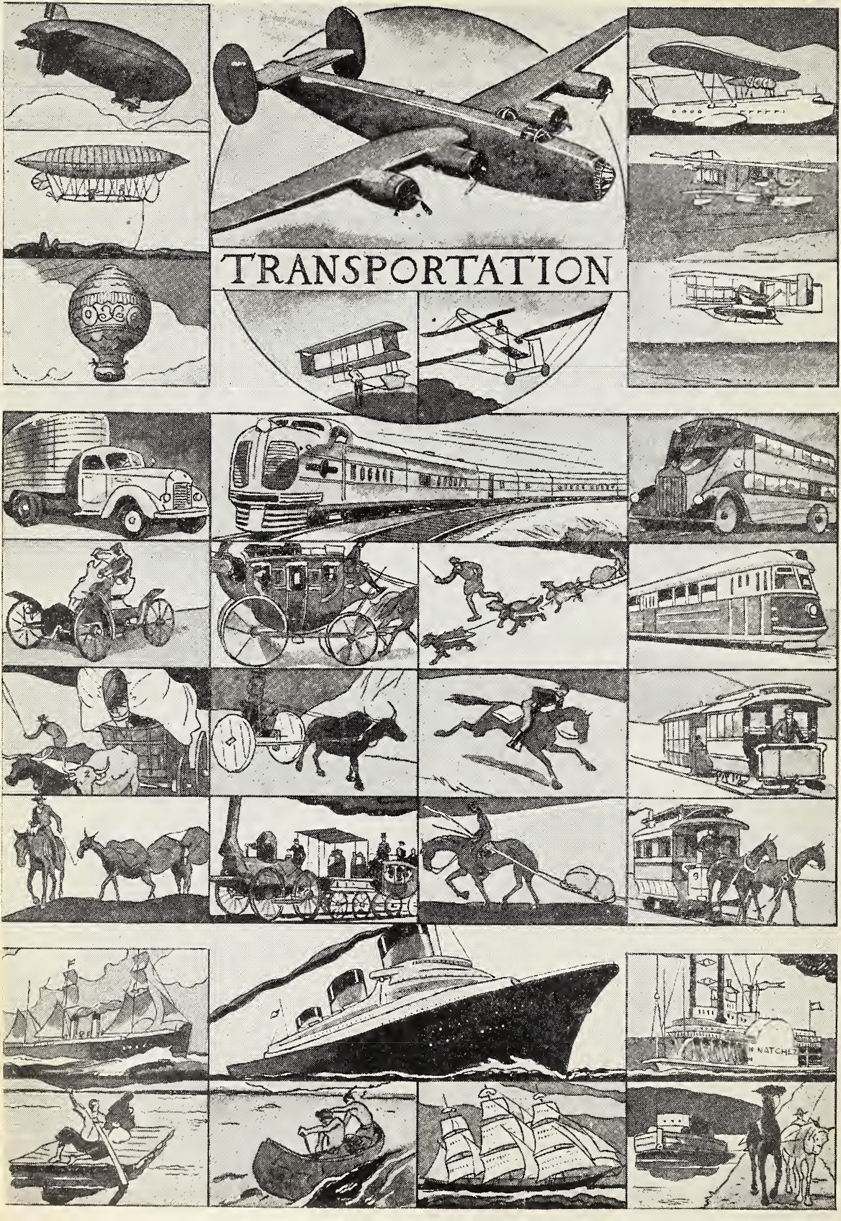


TRANSPORTATION

CHAPTER I

CHANGES IN TRANSPORTATION

The picture on the opposite page shows some of the chief changes which have taken place in transportation.

1. The covered wagon was first used for travel over the Western Plains about 1810. How long ago was that?

2. At an average speed of 16 miles a day, how many days did it take to travel in a covered wagon from Fort Garry to Battleford, a distance of about 720 miles as the wagons travelled? This time is equal to how many months of 30 days?

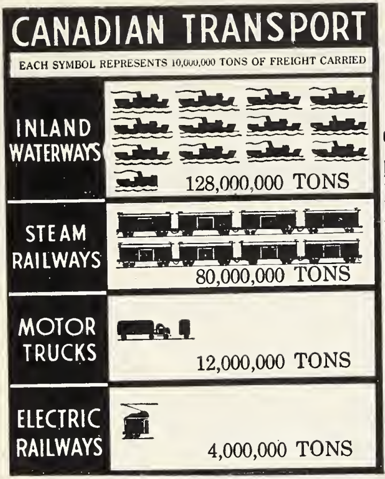
3. In 1886 the time required for the first rail trip from Montreal to Vancouver was 139 hours. About how many days of 24 hours was this?

4. In 1890 the speed record for a trip around the world was about 70 days. Fifty years later this had been cut to about 4 days. How many times as long did one trip take as the other?

*5. Name five important means for transporting people to-day. Rank these means in the order you think they should be according to the number of people transported a year in this country.

*6. State what is meant by each of the following: pack horse; horse trolley; stage coach; Indian travois; square rigger.

HOW WE TRANSPORT OUR PRODUCTS



The picture shows four different ways used to transport goods in our country. Each symbol on the graph represents 10,000,000 tons of freight carried at the time the graph was drawn.

1. How many symbols are used to represent the tonnage hauled by inland waterways. If one symbol represents 10,000,000 tons, show that the total amount handled by inland waterways is about equal to 128,000,000 tons. Are the two amounts exactly the same? about the same?

2. Why are some of the symbols cut off? About how many symbols represent the amount carried by motor trucks? by steam railways? by electric railways?

3. From the amounts given for each means of transportation, what is the total tonnage of the products carried?

4. Do the inland waterways transport more or less than two times as much as is transported by all of the other ways combined?

*5. Are any goods transported by inland waterway in your province? If so, name one product thus carried.

*6. Three of the four ways of transportation shown above could not have been used 125 years ago. Name them.

TRANSPORTATION BY AUTOMOBILE

1. What was the average yearly mileage for each automobile in operation in this country at the time the graph was drawn?

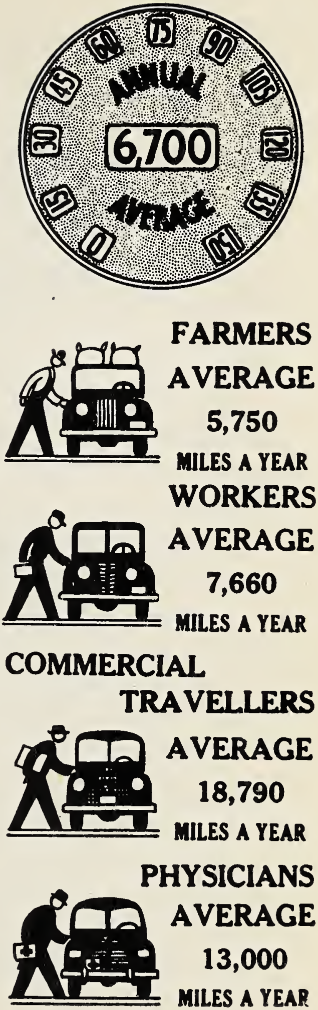
2. If there were 1,300,000 cars in use in this country, what was the yearly mileage by this means of transportation?

3. What was the average yearly mileage for the car of the farmer? of the worker? of the physician? of the commercial traveller?

4. How much more or less than the average mileage a car was the mileage for the car of each group (problem 3)?

5. At an average of 20 miles to the gallon, find the number of gallons of gasoline consumed by the average car in this country; by the car of the average farmer; of the average worker; of the average physician; of the average commercial traveller.

6. At an average cost of 35¢ a gallon, find the cost of the gasoline consumed yearly by the car of each group (problem 5).



MODERN SHIPS AND THEIR SPEEDS

It took Columbus 70 days to cross the Atlantic Ocean on his voyage of discovery. A modern express steamship made the crossing in less than 4 days.

1. How many times as long was the voyage of Columbus as the record crossing by ocean liner?

2. The best speed performances of ocean liners between Europe and New York before the outbreak of World War II were:

SHIP	MILES IN VOYAGE	TIME IN DAYS AND HOURS	AVERAGE MILES AN HOUR
Queen Mary	2938	3-20$\frac{2}{3}$	31.7
Normandie	2936	3-22$\frac{1}{10}$	31.2
Rex	3181	4-14	28.9
Bremen	3092	4-14$\frac{1}{2}$	28.0
Europa	3149	4-16$\frac{4}{5}$	27.9

a. Which ship took the least time for a crossing? How many hours was this?

b. Which two ships averaged about the same number of miles an hour?

c. Which ship travelled the greatest distance in crossing? the least distance? Find the difference. Give reasons for the differences.

3 Find the difference in the average number of miles an hour for the fastest and slowest ships.

4. The speed of a ship is measured in knots. A knot is equal to about 1$\frac{1}{6}$ miles per hour. If a ship has a speed of 27 knots, about what is its speed in miles per hour?

*5. If a ship has a speed of 28 miles an hour, about what is its speed in knots?

MEASURING YOUR ABILITY IN ARITHMETIC

How well do you understand arithmetic processes which you have studied? This test will show you.

First, copy all the examples on your paper, leaving plenty of space. When your teacher says, "Start," begin your work. You will be allowed 15 minutes for the test.

1. $\begin{array}{r} \frac{7}{8} \\ +\frac{7}{8} \\ \hline \end{array}$ 2. $\begin{array}{r} .25 \\ .74 \\ .86 \\ \hline \end{array}$ 3. $6 \times 4\frac{3}{4} = ?$ 4. $6 \div \frac{4}{5} = ?$

5. $\begin{array}{r} .176 \\ \times 5 \\ \hline \end{array}$ 6. $\begin{array}{r} 10\frac{1}{4} \\ -6\frac{3}{4} \\ \hline \end{array}$ 7. $\begin{array}{r} 8\frac{3}{4} \\ +4\frac{1}{2} \\ \hline \end{array}$ 8. $\begin{array}{r} 37.04 \\ -12.18 \\ \hline \end{array}$

9. $3\frac{3}{4} \div 2 = ?$ 10. $3\frac{3}{4} \times 6\frac{2}{3} = ?$ 11. $\begin{array}{r} 9.35 \\ \times 8.7 \\ \hline \end{array}$ 12. $\begin{array}{r} 9\frac{5}{8} \\ -2\frac{1}{6} \\ \hline \end{array}$

13. $25\overline{)6.75}$ 14. $8.3\overline{)31.872}$ 15. $\frac{3}{4} \times \frac{5}{6} = ?$ 16. $3\frac{1}{2} \div 1\frac{3}{4} = ?$

17. Find the sum of 8.9, 97.4, 86.3, and 0.8.
18. Change .75 to a common fraction.
19. Add 3 min. 15 sec. to 9 min. 50 sec.
20. Subtract 3 gal. 1 qt. from 5 gal.

After your paper has been marked, find what your score means.

What Your Score Means (Number correct)

Unsatisfactory	Fair	Good	Excellent
Less than 15	15 - 17	18 19	20

If your rating is less than "Excellent," you need to review the work you have had and to practice other examples like the ones you missed. Examples for extra practice are on pages 290–308.

HOW TO FIND THE PRACTICE YOU NEED

In Chapters I, II, and III of this book are **diagnostic** tests using whole numbers, fractions, and decimals. These tests are paged as shown by the following table:

Process	Page Number For		
	Whole Numbers	Fractions	Decimals
Addition	9	44	67
Subtraction	11	47	68
Multiplication	15	49	73
Division	22	55	90

1. On what page is the diagnostic test in addition of whole numbers? Before you take this test, study the work on page 7 which tells you the things to be careful about in addition.

2. Study the note below the addition test on page 9. On what pages can you find practice exercises keyed to the different parts of this diagnostic test? On which of these exercises should you practise? Before you begin to practise on some process, look over all of the practise exercises given for that process.

3. After you have completed the practice exercises, repeat the diagnostic test to see how much your work has improved.

4. In the same way, take the diagnostic test in each of the other processes listed. Remember, if you make no errors on a diagnostic test on some process, you need not practise the process. You may go on at once to the next diagnostic test.

5. Keep a record of your scores on the diagnostic tests to watch how your work improves.

MUSTS IN ADDITION OF WHOLE NUMBERS

In order to add whole numbers quickly and correctly, you **must:**

1. **Be able to give the sum of each of the 100 combinations** (page 290) instantly, without counting or guessing. See how rapidly you can give these combinations without error.

2. **Be able to give on sight the sum of any two-figure and any one-figure number.** To add the column downward think, "13, 21, 26."

$$\begin{array}{r} 7 \\ 6 \\ 8 \\ \underline{5} \end{array}$$

3. **Copy the numbers to be added so that the units** (6, 9, 2 in the example) **will form a straight line** from top to bottom of the column; likewise the tens (3, 4), the hundreds, and any other sets of digits contained in the numbers.

$$\begin{array}{r} 736 \\ 9 \\ \underline{42} \end{array}$$

4. **Add the numbers downward in order.** Think, "12, 16, 19, 25." **When zero is in the column, skip the zero and add the next figure.**

$$\begin{array}{r} 7 \\ 5 \\ 4 \\ 3 \\ 0 \\ \underline{6} \end{array}$$

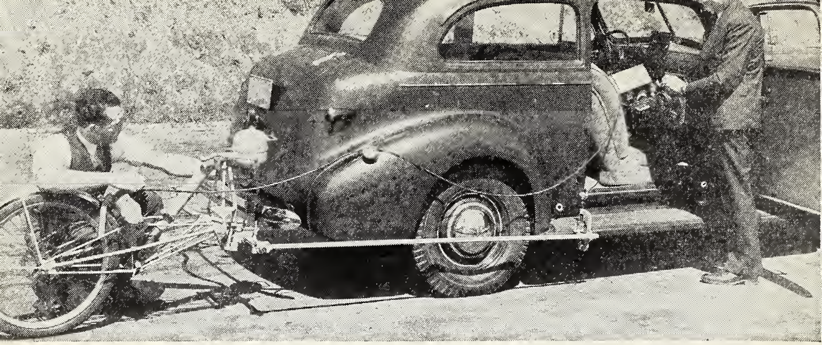
5. **Carry the correct number.** In the example, the sum of the ones' column is 20. Write 0; carry 2 to the top of the tens' column, add it to 4, and say "6, 11." The sum of the tens' column is 11. Write 1 in the tens' column; carry 1 to the top of the hundreds' column; say "7, 15, 18," write 18. What is the sum of the example shown?

$$\begin{array}{r} 645 \\ 856 \\ \underline{309} \end{array}$$

6. Check the sum by adding upward.

7. Use the "Musts" in addition of whole numbers in working the following examples:

   a. 596 + 475 + 398 + 479 + 964
   b. 73 + 790 + 487 + 984 + 806 + 564
   c. 7897 + 96 + 875 + 59 + 768 + 4



CHECKING HELPS ACCURACY

Mechanical devices, such as the speedometer of an automobile, must be correct. Even though the speedometer operates perfectly, the manufacturer checks it by actual road test. Tell how the speedometer in the picture above is being tested.

1. If the speedometer of the car tested is not accurate, why should it be adjusted?

2. What check do you use for addition? for subtraction? for multiplication? for division?

3. Solve each of the following examples and check the result:

a. $739 + 406 + 257 + 684 + 790 = ?$
b. $7302 - 5409 = ?$
c. $58 \times 367 = ?$
d. $28549 \div 56 = ?$

4. Most people check multiplication and division by going over the work. State another way for checking each of these processes.

5. State why accuracy in computation is necessary for the following groups of people: *a.* a ship's captain; *b.* an airplane pilot; *c.* a merchant; *d.* a clerk in a bank; *e.* a railroad engineer; *f.* a machinist.

DIAGNOSTIC TEST IN ADDITION OF WHOLE NUMBERS

Write each sum on a paper placed below the example.

	a	b	c
I.	7	3	6
(291)	4	6	9
	6	8	7
	9	5	4

	a	b	c
II.	6	2	9
(291)	8	6	9
	5	9	7
	9	4	8
	4	7	4
	3	6	5

	a	b	c
III.	58	42	65
(291)	34	51	18
	96	14	59
	50	20	72
	48	82	43
	31	39	27

	a	b	c
IV.	90	46	704
(291)	50	23	309
	40	75	205
	30	64	608
	60	38	503
	70	54	107

	a	b	c
V.	$1.19	916	907
(292)	30.76	53	2354
	.95	2741	68
	21.35	546	1131
	103.28	308	405
	2.87	77	82

VI. *a.* 3 qt. 1 pt. + 5 qt. 1 pt. = ?
(292)
b. 6 da. 12 hr. + 9 da. 16 hr. = ?

If you made errors on any of the above groups, turn to the pages in parentheses. Practise the sets of examples numbered the same as the groups you worked incorrectly.

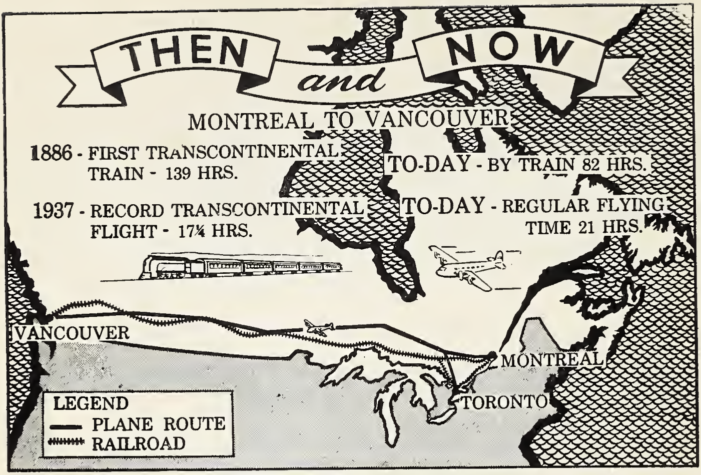
Be sure to keep a record of your scores on this test.

MAGIC SQUARE

A magic square, as you recall, is an arrangement of numbers in a square in such a way that the sum of the numbers in a row, a column, or along a diagonal is the same. The smallest magic square using numbers in order contains three numbers on a side as shown.

2	9	4
7	5	3
6	1	8

What is the sum of each row? each column? each diagonal?


THEN and NOW
MONTREAL TO VANCOUVER
1886 - FIRST TRANSCONTINENTAL TRAIN - 139 HRS.
1937 - RECORD TRANSCONTINENTAL FLIGHT - 17¼ HRS.
TO-DAY - BY TRAIN 82 HRS.
TO-DAY - REGULAR FLYING TIME 21 HRS.
VANCOUVER
MONTREAL
TORONTO
LEGEND
PLANE ROUTE
RAILROAD

BRIDGING THE MILES

1. What was the shortest time required to cross Canada from Montreal to Vancouver in 1886? In 1937?

2. How much faster was the plane trip of 1937 than the railroad trip of 1886?

3. About how long does it take to travel to-day from Montreal to Vancouver by train? By plane?

4. The record time for travelling from Montreal to Vancouver is about $17\frac{1}{4}$ hours. How much faster is this than the regular plane service?

5. The mileage by rail from Montreal to Vancouver is approximately 2930 miles. If this distance is travelled in 82 hours, what is the average number of miles an hour?

6. If the plane from Montreal to Vancouver travels the same distance, what is its average number of miles an hour?

MUSTS IN SUBTRACTION OF WHOLE NUMBERS

To subtract quickly and correctly, you **must:**

1. **Be able to give the answer to each of the 100 subtraction combinations** (page 290) instantly, without counting or guessing.

2. **Know how to change the next figure when one of the figures of the top number is smaller than the figure just below it.** In the example, you must think 3 as 13. What must you do to the other numbers as each subtraction is made?

$$\begin{array}{r}723\\ \underline{456}\end{array}$$

3. **Know how to work with zero.** In the example, the first zero must be thought of as 10. How must you change the middle zero of 600 in subtracting?

$$\begin{array}{r}600\\ \underline{208}\end{array}$$

4. **Know how to check the answer.** In the example, the sum of the remainder, 349, and the number subtracted, 87, must equal the larger number, 436.

$$\begin{array}{r}436\\ \underline{87}\\ 349\end{array}$$

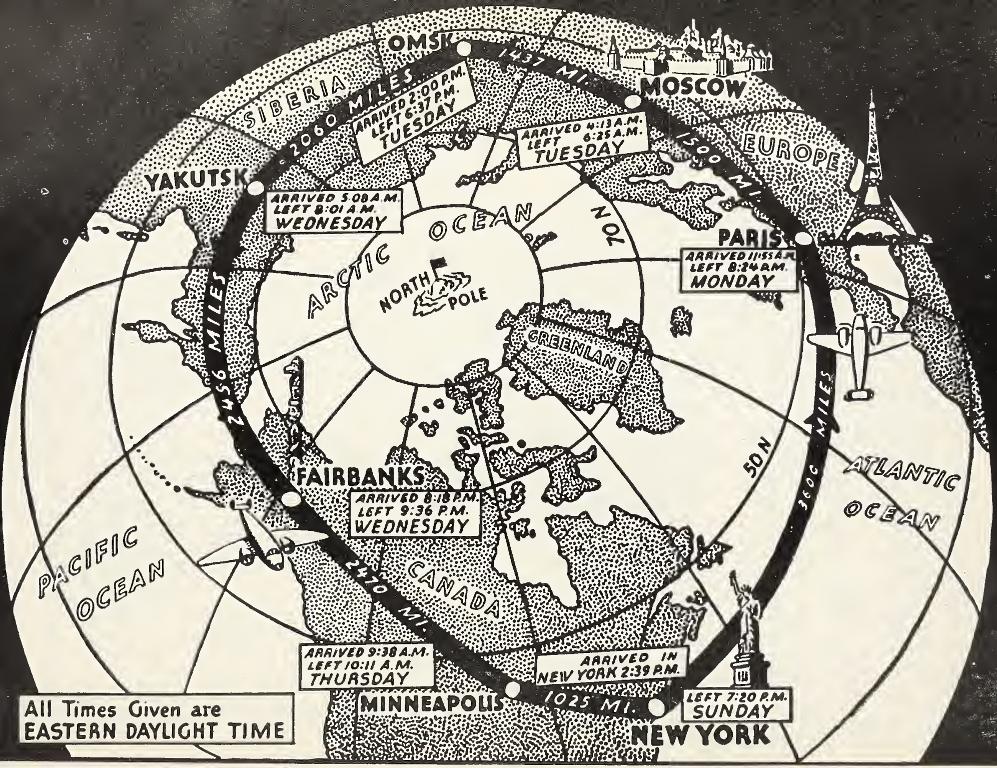
DIAGNOSTIC TEST IN SUBTRACTION

Write answers on folded paper placed below each row.

	a	*b*	*c*		*a*	*b*	*c*
I.	783	691	437	**IV.**	702	601	4005
(292)	456	238	219	(293)	148	307	2369
II.	526	916	738	**V.**	7000	6000	8007
(292)	350	254	642	(293)	2158	1092	3009
III.	621	734	610	**VI.**	7210	3018	704
(293)	184	158	274	(293)	56	39	9

VII. *a.* 12 da. $7\frac{1}{2}$ hr. − 4 da. $5\frac{1}{4}$ hr. = ?
(294) *b.* 4 ft. $3\frac{1}{2}$ in. − 1 ft. $7\frac{1}{4}$ in. = ?

If you made errors, turn to the key pages (in parentheses). Practise the sets having the same numbers as the groups you worked incorrectly.


OMSK
1437 MI.
MOSCOW
SIBERIA
2060 MILES
ARRIVED 2:00 P.M.
LEFT 6:37 P.M.
TUESDAY
ARRIVED 4:13 A.M.
LEFT 6:25 A.M.
TUESDAY
1500 MI.
EUROPE
YAKUTSK
ARRIVED 5:08 A.M.
LEFT 8:01 A.M.
WEDNESDAY
ARCTIC OCEAN
70 N
PARIS
ARRIVED 11:55 A.M.
LEFT 8:24 A.M.
MONDAY
NORTH POLE
GREENLAND
2456 MILES
3600 MILES
50 N
ATLANTIC OCEAN
FAIRBANKS
ARRIVED 8:18 P.M.
LEFT 9:36 P.M.
WEDNESDAY
PACIFIC OCEAN
2470 MI.
CANADA
ARRIVED 9:38 A.M.
LEFT 10:11 A.M.
THURSDAY
ARRIVED IN NEW YORK 2:39 P.M.
MINNEAPOLIS
1025 MI.
LEFT 7:20 P.M.
SUNDAY
NEW YORK

All Times Given are
EASTERN DAYLIGHT TIME

AROUND THE WORLD IN THREE DAYS

On July 10, 1938, Howard Hughes and a crew of four men started from New York on a flight around the world. The flight was completed July 14, in about 3 days, $19\frac{1}{4}$ hours.

1. A previous record for a round-the-world trip was made by Wiley Post. The time for his flight was about 7 days, $18\frac{3}{4}$ hours; or about $186\frac{3}{4}$ hours. Did Hughes take more or less than half as much time for the trip as Post?

2. The distance between landings on the flight by Hughes is given in the following table:

FROM	TO	NUMBER OF MILES
New York	Paris	3600
Paris	Moscow	1500
Moscow	Omsk	1437
Omsk	Yakutsk	2060
Yakutsk	Fairbanks	2456
Fairbanks	Minneapolis	2470
Minneapolis	New York	1025

Find the total distance for the trip.

3. What was the shortest distance between landings? the longest distance?

4. The actual flying time for the Hughes trip was 72 hours, 12 minutes. Show that this time is equal to $72\frac{1}{5}$ hours.

5. Counting the flying time as 72 hours, was the average distance flown an hour more or less than 200 miles? About how much more or less?

***6.** On June 28, 1939, a passenger left New York on a Pan American flying boat, and completed a round-the-world trip by commercial air lines in 16 days, 19 hours, 4 minutes. How much longer than the Hughes record was this?

MUSTS IN MULTIPLICATION

To do good work in multiplication you **must:**

1. **Know the multiplication facts or combinations.** Turn to page 290 and give the correct answer to each fact. How well do you know the following combinations?

$$\begin{array}{r} 8 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 1 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline \end{array}$$

2. **Carry correctly after multiplying.** In the example, think as follows: "Nine 8's are 72. Write 2 and carry 7. Nine 6's are 54. 54 + 7 are 61. Write 61." How can you show that the example is correct without using multiplication?

$$\begin{array}{r} \mathbf{68} \\ \mathbf{\times 9} \\ \hline \mathbf{612} \end{array}$$

3. **Place the numbers correctly.** In the illustration, a partial product of 457 and 203 is given. Copy and complete the example.

$$\begin{array}{r} \mathbf{457} \\ \mathbf{\times 203} \\ \hline \mathbf{1371} \end{array}$$

4. **Know how to check the work.** There are several ways in which an example in multiplication may be checked. The two most widely used methods of checking are: *a.* go over the work; or *b.* interchange the numbers and then multiply. If the second method for checking is used, the example above is written as shown here. Copy and check the product by this method. Why do you not use the same method for checking this example as you used in problem 2?

$$\begin{array}{r} \mathbf{203} \\ \mathbf{\times 457} \\ \hline \end{array}$$

FINDING ERRORS IN MULTIPLICATION

Find the errors in the following examples:

$$1.\ \begin{array}{r} 49 \\ \times 2 \\ \hline 818 \end{array} \qquad 2.\ \begin{array}{r} 206 \\ \times 7 \\ \hline 1402 \end{array} \qquad 3.\ \begin{array}{r} 58 \\ \times 3 \\ \hline 214 \end{array} \qquad 4.\ \begin{array}{r} 68 \\ \times 37 \\ \hline 484 \\ 2040 \\ \hline 2524 \end{array} \qquad 5.\ \begin{array}{r} 308 \\ \times 204 \\ \hline 1232 \\ 6160 \\ \hline 7392 \end{array}$$

DIAGNOSTIC TEST IN MULTIPLICATION

Multiply in the examples given below. Check your work.

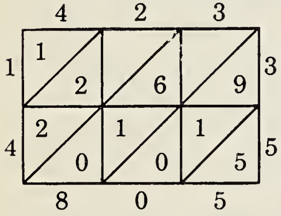
	a	b	c		a	b	c
I.	58	76	34	**IV.**	308	670	4800
(294)	8	9	6	(295)	81	29	23
II.	906	304	4007	**V.**	514	476	960
(294)	9	2	7	(295)	238	306	204
III.	64	27	734	**VI.**	5203	470	6001
(294)	38	58	26	(295)	400	60	708

VII.

(295) *a.* 4 × 3 ft. 6 in. = ? *b.* 9 × 4 hr. 15 min. = ?

If you made errors on any of these seven groups of examples, turn to the key pages (in parentheses). Practise the sets of examples having the same numbers as the examples you worked incorrectly.

LATTICEWORK IN MULTIPLICATION



During the Middle Ages in Europe a method widely used for multiplication was known as **latticework.** If a three-figure number, such as 423, was multiplied by a two-figure number, such as 35, a form was drawn.

First, 423 was multiplied by 3 as shown in the top row. Next, 423 was multiplied by 5. When the product was a two-figure number, both figures were written. The result, 14,805, was found by adding the numbers in the latticework in the diagonal columns. The sum for the first column is 5; the second is 10, so zero was written in the result and 1 was carried to the next diagonal column. Check the result.

*NINE AN INTERESTING NUMBER

TABLE OF 9's	
1	9
2	18
3	27
4	36
5	45
6	54
7	63
8	72
9	81

Billy made a table of 9's. He studied this table and found that the sum of the figures in each product is 9.

I. If the sum of the digits of a number is 9, this number can be divided evenly by 9.

1. Find the sum of the digits of the following numbers and state which numbers may be divided evenly by 9:

a. 54 *b.* 76 *c.* 17 *d.* 63 *e.* 36 *f.* 270 *g.* 432 *h.* 162

II. If a number cannot be divided evenly by 9 and the sum of its digits is less than 9, this sum will be the remainder after the division by 9. The sum of the digits in 24 is 6: 24 ÷ 9 = 2, and 6 remaining.

2. What is the remainder when the following numbers are divided by 9? (Find the sum of the digits of the number and check the result by division.)

a. 14 *b.* 32 *c.* 80 *d.* 61 *e.* 304 *f.* 512 *g.* 1231

III. The sum of the digits of a number may be more than 9. The sum of the digits of the number, 475, is 16. The sum of the digits in 16 is 7, the remainder when 475 is divided by 9. Show that 7 is the remainder in $9\overline{)475}$.

a. Can 468 be divided evenly by 9? The sum of the digits is 4 + 6 + 8, or 18. The sum of the digits in 18 is 1 + 8, or 9, so 468 can be divided evenly by 9.

b. Can 537 be divided evenly by 9? The sum of the digits is 5 + 3 + 7, or 15. The sum of the digits in 15 is 1 + 5, or 6, so 537 cannot be divided evenly by 9, and the final remainder is 6.

3. Without dividing, find if the following numbers can be divided evenly by 9. If not, give the final remainder:

a. 406; *b.* 138; *c.* 1791; *d.* 638; *e.* 4662; *f.* 30,487.

★CHECKING MULTIPLICATION BY CASTING OUT NINES

The method for finding the remainder when a number is divided by 9 (page 16) is called **casting out 9's.** Casting out 9's may be used to check multiplication. Study the example.

The sum of the digits in 436 is 13; 1 + 3 = 4. When 9's are cast out of 436, the remainder is 4. When 9's are cast out of 23, the remainder is 5. Now multiply 4 by 5. The product is 20. Cast out 9's in this number and the remainder is 2.

$$\begin{array}{r} 436\\ \underline{\times 23}\\ 1308\\ \underline{8720}\\ 10028 \end{array} \qquad \begin{array}{c} \text{CASTING OUT 9'S}\\ 4\\ \underline{\times 5}\\ 20 \end{array}$$

$$2+0=2$$

$$1+2+8=11$$

$$1+1=2$$

Find the sum of the digits in the product, 10,028. The sum of 1 + 0 + 0 + 2 + 8 is 11. The sum of the digits in 11 is 2, the same as in 20. So very probably the answer to the example is correct.

When a number is divided evenly by 9, there is no remainder. In that case, zero is written for checking by casting out 9's. Study the example. Since the sum of the digits in the product is 9, there is no remainder, or 0. This is the same as the product of the check numbers. So very probably the example is correct.

$$\begin{array}{r} 486\\ \underline{\times 35}\\ 2430\\ \underline{14580}\\ 17010 \end{array} \qquad \begin{array}{r} 0\\ \underline{\times 8}\\ 0 \end{array}$$

$$1+7+0+1+0=9$$

Multiply the following examples. Check the result by casting out 9's.

1. $\begin{array}{r} 426\\ \underline{24} \end{array}$ **2.** $\begin{array}{r} 308\\ \underline{76} \end{array}$ **3.** $\begin{array}{r} 579\\ \underline{102} \end{array}$ **4.** $\begin{array}{r} 604\\ \underline{504} \end{array}$

PROBLEMS WITHOUT NUMBERS

In the following problems, tell whether to add or subtract:

1. If you had a certain amount of money and spent part of it, how do you find the amount you had left?

2. You know the total number of black and white marbles in a bag. If you know the number of black marbles, how do you find the number of white marbles?

3. If you know the amount of money which Mary earned on two different days, how do you find the amount she earned both days?

4. You know the amount of money Jane had left after she spent some of it and also the amount she spent. How do you find the amount she had at first?

5. Walter needs a certain amount of money to buy a baseball. If you know the amount he now has and the cost of the ball, how do you find the amount he needs?

6. If you know the sum of two numbers and one of the numbers, how do you find the other number?

7. If you know the difference between two numbers and the smaller number, how do you find the larger number?

*8. Make problems with numbers to illustrate each of the seven previous problems.

A MAGIC SQUARE

The square on the right has some of its cells vacant.

1. Copy this square and fill in the missing numbers.

*2. If the cell containing 15 were vacant, could you find all of the missing numbers? Explain.

?	2	3	13
5	11	10	?
9	?	6	12
?	14	15	?

FROM MAGELLAN TO HUGHES

Record-breaking trips around the world:

FERDINAND MAGELLAN—3 years 27 days—August 10, 1519, to September 6, 1522—by ship from Seville, via the Strait of Magellan.

NELLIE BLY—70 days 6 hours 11 minutes—November 14, 1889, to January 25, 1890—a reporter for "The World," who wrote under the name of Nellie Bly.

CHARLES FITZMORRIS—60 days 13 hours 20 minutes—1901—by way of the Suez Canal. Fitzmorris was retired Chief of Police of Chicago.

J. WILLIS SAYRE—54 days 9 hours 42 minutes—1903—by way of Suez.

HENRY FREDERICK—54 days 7 hours 2 minutes—1903—by way of Suez.

COLONEL BURNLAY-CAMPBELL, an Englishman—42 days 19 hours 30 minutes—1907—first round-the-world traveller to utilize the Trans-Siberian Railway.

JOHN HENRY MEARS, New York theatrical producer—35 days 21 hours 35 minutes—July 2 to August 6, 1913—by steamship, the Trans-Siberian, and seaplane, the first round-the-world racer to use aircraft.

LINTON WELLS, newspaper man, and Edward S. Evans, of Detroit—28 days 14 hours 36 minutes 5 seconds—1926—from New York June 16, using airplanes for about half the distance.

CAPTAIN C. B. D. COLLYER AND JOHN HENRY MEARS—23 days 15 hours 21 minutes 3 seconds—1928—from New York June 29, by airplane and boat.

DIRIGIBLE GRAF ZEPPELIN—20 days 4 hours—1929—starting from Friedrichshafen, Germany, August 10.

WILEY POST—7 days 18 hours 49½ minutes—1933—by airplane.

H. R. ("BUD") EKINS, newspaper man—18 days 14 hours 56 minutes—1936—as a passenger on scheduled flights by commercial airlines.

HOWARD HUGHES AND CREW OF FOUR—3 days 19 hours 17 minutes—1938—by airplane.

Answer each question to the nearest whole day:

1. What was the time of the fastest trip around the world before the beginning of this century?

2. Between 1900 and 1924, what was the time of the fastest trip around the world? between 1925 and 1934?

★**3.** From 1935 to the present, what was the time of the fastest trip around the world?

★**4.** What means of transportation have enabled travellers to reduce the time for making a round-the-world trip?

MUSTS IN DIVISION OF WHOLE NUMBERS

To do good work in division of whole numbers you **must:**

1. **Know the division facts.** Turn to page 290 and give the correct answers to the 90 even division facts.

2. **Remember that the remainder must always be smaller than the number by which you divide.** Show the error in the example.

$$\begin{array}{r} 114 \\ 3\overline{)72} \\ \underline{3} \\ 4 \\ \underline{3} \\ 12 \\ \underline{12} \end{array}$$

3. **Be able to multiply and subtract correctly.** What is the error in the example? Is each multiplication correct?

$$\begin{array}{r} 46 \\ 7\overline{)312} \\ \underline{28} \\ 42 \\ \underline{42} \end{array}$$

4. **Place the quotient figure correctly.** What is incorrect in the example? When dividing by a one-figure number, the first figure in the quotient should be placed above either the first or second figure (from the left) of the number divided. When should the first quotient figure be placed directly above the first figure of the number divided? above the second figure?

$$\begin{array}{r} 36 \\ 8\overline{)288} \\ \underline{24} \\ 48 \\ \underline{48} \end{array}$$

5. **Bring down the figures in order.** Show the error in the example.

$$\begin{array}{r} 191 \\ 4\overline{)746} \\ \underline{4} \\ 36 \\ \underline{36} \\ 4 \\ \underline{4} \end{array}$$

6. **Write the final remainder in the result.** The final remainder may also be written as a fraction. In the example the quotient also may be expressed as $12\frac{3}{5}$.

$$\begin{array}{r} 12\text{ r}3 \\ 5\overline{)63} \\ \underline{5} \\ 13 \\ \underline{10} \\ 3 \end{array}$$

7. **Check the result.** An example in division may be checked by multiplying the quotient by the number divided and adding the final remainder to that product. This sum should equal the number divided. You can also check division by going over the work.

ERRORS IN DIVISION—ONE-FIGURE DIVISOR

Errors in division are shown below. Solve each example. Find the error.

1. $$\begin{array}{r} 28 \\ 7\overline{)206} \\ \underline{14} \\ 56 \\ \underline{56} \end{array}$$

2. $$\begin{array}{r} 19 \\ 5\overline{)950} \\ \underline{5} \\ 45 \\ \underline{45} \\ 0 \end{array}$$

3. $$\begin{array}{r} 6\ 3 \\ 6\overline{)3618} \\ \underline{36} \\ 18 \\ \underline{18} \end{array}$$

4. $$\begin{array}{r} 46\text{ r}5 \\ 7\overline{)3225} \\ \underline{28} \\ 42 \\ \underline{42} \\ 5 \end{array}$$

5. $$\begin{array}{r} 48 \\ 9\overline{)435} \\ \underline{36} \\ 75 \\ \underline{75} \end{array}$$

6. $$\begin{array}{r} 516 \\ 8\overline{)528} \\ \underline{40} \\ 12 \\ \underline{8} \\ 48 \\ \underline{48} \end{array}$$

7. $$\begin{array}{r} 685 \\ 4\overline{)2742} \\ \underline{24} \\ 34 \\ \underline{32} \\ 22 \\ \underline{20} \end{array}$$

8. $$\begin{array}{r} 751 \\ 7\overline{)5327} \\ \underline{49} \\ 42 \\ \underline{42} \\ 7 \\ \underline{7} \end{array}$$

9. $$\begin{array}{r} 529 \\ 6\overline{)4174} \\ \underline{30} \\ 17 \\ \underline{12} \\ 54 \\ \underline{54} \end{array}$$

ERRORS IN DIVISION—TWO-FIGURE DIVISOR

1. $$\begin{array}{r} 24 \\ 24\overline{)5760} \\ \underline{48} \\ 96 \\ \underline{96} \end{array}$$

2. $$\begin{array}{r} 51\text{ r}1 \\ 34\overline{)1635} \\ \underline{170} \\ 35 \\ \underline{34} \\ 1 \end{array}$$

3. $$\begin{array}{r} 610 \\ 26\overline{)1820} \\ \underline{156} \\ 26 \\ \underline{26} \\ 0 \end{array}$$

4. $$\begin{array}{r} 73 \\ 57\overline{)4032} \\ \underline{389} \\ 152 \\ \underline{152} \end{array}$$

5. $$\begin{array}{r} 57\text{ r}3 \\ 16\overline{)9123} \\ \underline{80} \\ 112 \\ \underline{112} \\ 3 \end{array}$$

6. $$\begin{array}{r} 81 \\ 86\overline{)6930} \\ \underline{688} \\ 150 \\ \underline{86} \\ 76 \end{array}$$

7. $$\begin{array}{r} 26 \\ 14\overline{)1372} \\ \underline{28} \\ 92 \\ \underline{84} \end{array}$$

8. $$\begin{array}{r} 42 \\ 78\overline{)3176} \\ \underline{302} \\ 156 \\ \underline{156} \end{array}$$

DIAGNOSTIC TESTS IN DIVISION

One-figure divisor—Copy, divide, and check.

		a	b			a	b
I.	(296)	$9\overline{)3888}$	$8\overline{)5876}$	**III.**	(296)	$5\overline{)852}$	$3\overline{)2702}$
II.	(296)	$6\overline{)3615}$	$4\overline{)5400}$	**IV.**	(296)	$9\overline{)1312}$	$6\overline{)5201}$

V. (297) *a.* $3\overline{)4 \text{ hr. } 15 \text{ min.}}$ *b.* $5\overline{)12 \text{ ft. } 8 \text{ in.}}$

If you made errors on any of the five groups of examples, turn to the key pages (in parentheses). **Practise** the sets of examples having the same numbers as the groups you worked incorrectly.

Two-figure divisor—Copy, divide, and check.

		a	b			a	b
I.	(297)	$21\overline{)672}$	$32\overline{)749}$	**V.**	(298)	$28\overline{)2613}$	$37\overline{)3145}$
II.	(297)	$46\overline{)1853}$	$35\overline{)7145}$	**VI.**	(298)	$29\overline{)1825}$	$38\overline{)2410}$
III.	(297)	$87\overline{)7093}$	$96\overline{)6158}$	**VII.**	(298)	$16\overline{)9121}$	$15\overline{)14400}$
IV.	(298)	$48\overline{)1248}$	$56\overline{)3728}$				

If you made errors on any of the seven groups of examples, turn to the key pages (in parentheses). **Practise** the sets of examples having the same numbers as the groups you worked incorrectly.

⋆TOPICS FOR SPECIAL REPORTS

1. The speed of ships is usually measured in knots. Find how the length of the knot originally was determined.

2. Show that an example in multiplication may be incorrect but still check by casting out 9's.

3. Show how to check an example in division by casting out 9's.

NUMBERS HAVE PLACE VALUE

1. Harry wrote the number, 55,555, as shown. Each figure, as you recall, has its **place value.** The first 5 represents five 1's; the next 5 represents five 10's. What does each of the other 5's represent?

2. From right to left in the example, each figure is how many times as large as the previous figure? From left to right, each figure is what part of the value of the previous figure?

$$\begin{array}{r} 5 \\ 50 \\ 500 \\ 5000 \\ 50000 \\ \hline 55555 \end{array}$$

3. Write the number, 40,093, by giving each figure its place value. Why is 0 sometimes called a "place holder"?

4. Arthur saw a news item which stated that a bank in Montreal had just received a thousand one-thousand-dollar bills. How much is a thousand thousand dollars? Write this number with figures.

5. A certain speedometer indicates a number of 5 figures or places. What is the largest number that can be registered on this speedometer?

6. Jane read in her science book that the earth is at least two thousand million years old. Write this number with figures. What is another way to read this number?

7. The distance that light travels in one year is called a **light year.** This distance is about six million million miles. Write this number with figures. What is another way to read this number?

*8. Find the debt of our national government. Write this amount with figures. What is another way to read this amount?

*9. Do numbers have place value in the Roman number system? Why is it difficult to divide or to multiply Roman numerals?

PLACING THE FIRST QUOTIENT FIGURE

1. How many tens and how many ones are in:

a. 380 *b.* 972 *c.* 1230 *d.* 1040

2. How many hundreds are in each of the following:

a. 724 *b.* 3240 *c.* 5602 *d.* 1110 *e.* 2175

3. There are how many hundreds in 329?

4. In the example shown, can the hundreds be divided by 7? There are how many tens in 329? Can the tens be divided by 7? Would the first quotient figure be placed over the 3 or the 2? Why?

$7\overline{)329}$

5. How many thousands are in the number 1290? How many hundreds? how many tens?

6. In the example shown, can the thousands be divided by 43? Can the hundreds be divided by 43? Would the first quotient figure be placed over the 2 or the 9? Why?

$43\overline{)1290}$

7. How many thousands are in 7560? how many hundreds? how many tens?

8. In the example shown, can the thousands be divided by 210? the hundreds by 210?

$210\overline{)7560}$

9. As there are 756 tens in 7560, the tens can be divided by 210. Would the first figure in the quotient be placed over the 5 or the 6? Why?

10. Tell where the first figure should go:

a. $17\overline{)496}$
b. $9\overline{)1438}$
c. $59\overline{)846}$
d. $7\overline{)1684}$
e. $421\overline{)9680}$
f. $302\overline{)1546}$
g. $723\overline{)24758}$
h. $200\overline{)3812}$
i. $165\overline{)42960}$
j. $366\overline{)1250}$
k. $180\overline{)5437}$
l. $291\overline{)16387}$

11. Tell where the first figure of the quotient is placed when the divisor is a one-figure number; a two-figure number; a three-figure number.

DIVIDING BY A THREE-FIGURE NUMBER

1. Mrs. Smith's gas and light bills for last year amounted to \$87.60. What was the average daily cost of gas and light?

\$87.60 is 87 dollars and 60 cents, or 876 dimes.

$$\begin{array}{r} \$\ \ \ .24 \\ 365\overline{)\$87.60} \\ \underline{73\ 0} \\ 14\ 60 \\ \underline{14\ 60} \end{array}$$

You cannot divide the number of dollars, 87, by 365, so divide the number of dimes, or 876, by 365. You can find the quotient by dividing 8 by 3, which is 2. The 2 is written in the quotient in the dimes' place above 6.

The number of cents in the quotient may be found by dividing 14 by 3. The average daily cost is 24¢.

To divide by a three-figure number, use the figure in the hundreds' place to estimate the quotient figure.

Copy and complete each of the following examples:

2. $\begin{array}{r} 3 \\ 320\overline{)960} \end{array}$

3. $\begin{array}{r} 2 \\ 451\overline{)925} \end{array}$

4. $\begin{array}{r} 3 \\ 124\overline{)385} \end{array}$

5. $\begin{array}{r} 7 \\ 902\overline{)6328} \end{array}$

6. $\begin{array}{r} ?\ \text{r}15 \\ 420\overline{)855} \end{array}$

7. $\begin{array}{r} ?\ \text{r}21 \\ 126\overline{)273} \end{array}$

8. $\begin{array}{r} ?\ \text{r}26 \\ 304\overline{)1850} \end{array}$

9. $\begin{array}{r} ?\ \text{r}14 \\ 513\overline{)3092} \end{array}$

10. $\begin{array}{r} 3? \\ 210\overline{)6510} \end{array}$

11. $\begin{array}{r} 4? \\ 306\overline{)12852} \end{array}$

12. $\begin{array}{r} 5? \\ 512\overline{)27166} \end{array}$

13. $\begin{array}{r} ?3 \\ 413\overline{)17759} \end{array}$

Copy and divide each of the following examples:

14. $201\overline{)804}$

15. $613\overline{)1839}$

16. $725\overline{)3625}$

17. $619\overline{)2500}$

18. $342\overline{)2399}$

19. $528\overline{)4312}$

20. $664\overline{)1350}$

21. $126\overline{)378}$

22. $384\overline{)3729}$

CORRECTING THE ESTIMATED QUOTIENT

1. At a high school football game, the receipts from the sale of 675 tickets amounted to $189.00. What was the average price of a ticket?

$$\begin{array}{r} \$\ .28 \\ 675\overline{)\$189.00} \\ \underline{135\ 0} \\ 54\ 00 \\ \underline{54\ 00} \end{array}$$

Think, "There are three 6's in 18. But I see that 3 is too large, so I will try 2." To find the second figure in the quotient, think, "There are nine 6's in 54, but I can see that 9 is too large, so I will try 8."

The average price of a ticket was 28¢.

If the quotient figure which you estimate is too large, try the next smaller figure.

2. Robert said that he judged the average cost in problem 1 to be between 20¢ and 30¢, with the correct amount much closer to 30¢ than to 20¢. Show how he did this.

Copy and divide the following examples:

3. $314\overline{)7850}$
4. $708\overline{)59632}$
5. $318\overline{)65197}$
6. $537\overline{)19450}$
7. $914\overline{)43000}$
8. $473\overline{)16575}$
9. $235\overline{)3075}$
10. $241\overline{)55430}$
11. $136\overline{)46253}$

12. If the divisor is a five-figure number, which figure is used for estimating the quotient? Estimate the quotient figure in the example $65430\overline{)278549.}$

13. If the divisor contains any number of figures, which figure is used for estimating the quotient?

14. How can you tell where the first quotient figure should be placed in any example?

LET'S PRACTISE A SET A DAY

Set I

1. $524\overline{)18864}$ 4. $165\overline{)34658}$ 7. $180\overline{)32400}$

2. $605\overline{)32990}$ 5. $720\overline{)20160}$ 8. $365\overline{)74467}$

3. $416\overline{)12485}$ 6. $314\overline{)87925}$ 9. $125\overline{)43751}$

10. If the divisor is a four-figure number, as 3178, which figure is used for estimating the quotient figure? Estimate the quotient figure in the example $3178\overline{)6419.}$

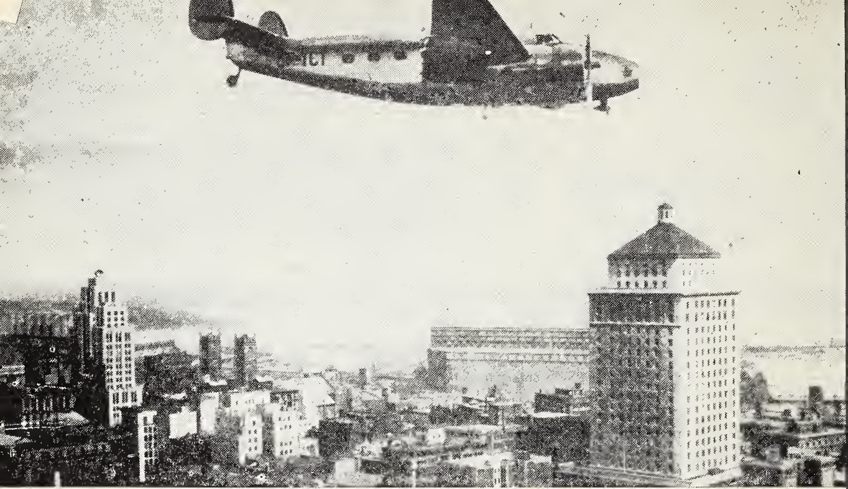
*11. If the divisor is a five-figure number, as 52,734, which figure is used for estimating the quotient? Estimate the quotient figure in the example $52734\overline{)293865}$.

Set II

1. 736 + 458 + 3685 + 98 + 768.
2. *a.* 9001 − 3682 *b.* 70,106 − 30,508.
3. Find the product of 486 and 907.
4. How much greater is 3814 than 2975?
5. What number multiplied by 15 will give a product of 255?
6. Multiply 9 ft. 4 in. by 3.

Set III

1. Divide: *a.* $7\overline{)3100}$ *b.* $8\overline{)5411}$ *c.* $9\overline{)5121}$
2. Divide: *a.* $14\overline{)710}$ *b.* $26\overline{)2354}$ *c.* $38\overline{)11628}$
3. Divide: *a.* $405\overline{)9315}$ *b.* $618\overline{)27815}$ *c.* $216\overline{)65664}$
4. *a.* 7 yd. 2 ft. + 5 yd. 1 ft. *b.* 4 gal. 3 qt. + 7 gal. 2 qt.
5. *a.* 14 ft. 6 in. − 7 ft. 9 in. *b.* 10 lb. 7 oz. − 6 lb. 9 oz.
6. Find the missing numbers: *a.* 5$\frac{3}{4}$ ft. = 5 ft. (?) in.
   b. 9 lb. 12 oz. = 9 ? lb. *c.* 3 hr. 15 min. = 3 ? hr.



MONTREAL—OUR LARGEST CITY

Population, 1921 (in **round numbers**)	618,000
Population, 1941 (in **round numbers**)	903,000

1. What was the population of Montreal in 1921? The exact number of people was 618,506. What is the difference between these two amounts?

2. What was the population of Montreal in 1941? The exact number of people was 903,007. What is the difference between these two amounts?

3. The census figures were rounded off to the nearest thousand. Three zeros were used to represent the figures which give the exact value. What figures in the exact numbers were replaced by zeros for the number representing the population in 1921? in 1941? Why were round numbers used?

4. From your study of problems 2 and 3, does it make much difference if the exact or the rounded, called **approximate**, figures are given? Which are easier to understand—exact or approximate amounts?

WE ROUND OFF NUMBERS

In a recent year, 343,608,564 bushels of wheat were exported from Canada. For practical purposes, this number is 344,000,000.

The first two or three figures on the left of a number usually give sufficient value for an understanding of the number. When you see the number of bushels of wheat exported from Canada given as 340,000,000, the first two figures of the exact number have been kept. You do not know if the first zero to the right of the 34 is the exact amount or not. Why?

Observe the following rules in rounding off a number:

a. **If the first figure to be dropped is 5 or more, make the next figure to the left one more.** Thus, 83,690, rounded off to the nearest thousand, is 84,000 because the first figure dropped (6) is more than 5. So the 3 is increased to 4.

b. **If the first figure to be dropped is less than 5, do not change the first figure to the left of it.** Thus, 19,380, to the nearest thousand, is 19,000 because 3 is less than 5.

c. **Replace each figure dropped with a zero.**

1. Round off the following numbers to the nearest hundred: *a.* 439; *b.* 7658; *c.* 449; *d.* 28,450.

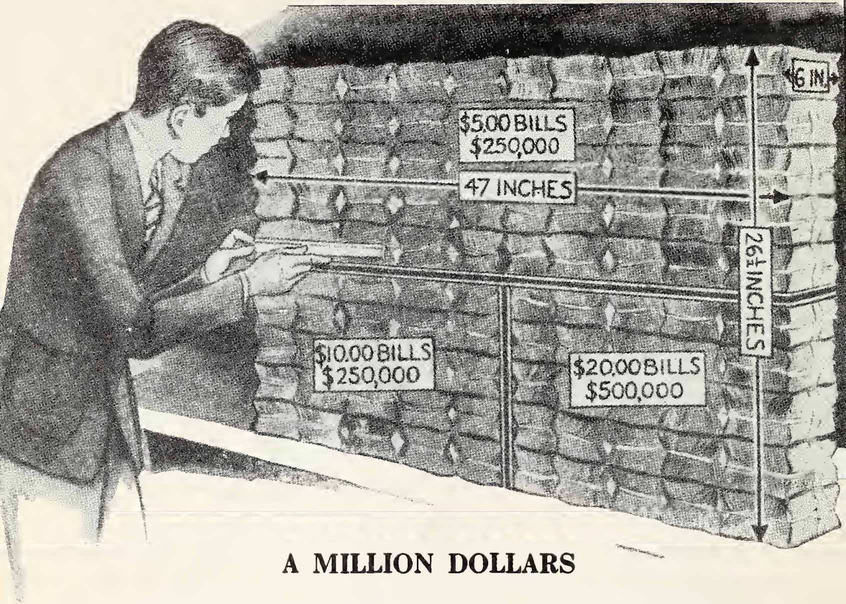
2. Round off the following numbers to the nearest thousand: *a.* 10,500; *b.* 75,499; *c.* 69,580; *d.* 150,875.

3. Round off the following numbers to the nearest million: *a.* 175,398,000; *b.* 92,489,000; *c.* 3,685,000; *d.* 1,499,000.

*4. Find the cost of operating the public schools in your city or province for the present year and round off this amount to the nearest ten thousand dollars.

*5. Find the population of your province and round it off to the nearest hundred thousand.

*6. Find the value of the most valuable crop in your province and round it off to the nearest hundred thousand dollars.



A MILLION DOLLARS

The picture shows 100,000 currency bills of different amounts. The value of these bills is $1,000,000.

1. What three different kinds of bills are shown in the stack? What is the total value of each kind? Which kind takes up the most space?

2. What is the length of the entire stack of bills? the height? the width?

3. If there are 100,000 bills and their value is $1,000,000, what is the average value of each bill?

4. To make a million dollars, how many 20-dollar bills are needed? how many 10-dollar bills? 5-dollar bills? 1-dollar bills? 100-dollar bills?

5. There are 10 bundles of bills in a row and the pile is 10 rows high. There are how many bundles in the pile?

6. If there are 100,000 bills, how many bills are in each bundle? (problem 5.)

7. If the number of bills in a bundle remained the same, how many bundles of $1-bills would it take to make a million dollars?

8. How many stacks of bills of the kinds shown would it take to make $1,000,000,000?

9. In one billion, there are how many millions? how many thousands? how many hundreds?

10. If the width of the pile remains the same, but the length is 100 times as much as shown in the picture, how high must the pile be to contain $1,000,000,000?

11. Referring to problem 10, about how many feet is the length of the billion-dollar stack of bills? the height?

12. If the length and width remained the same as in problem 10, what would be the height of the stack of bills which contained $10,000,000,000?

*13. Do you think the bills in problem 12 could be stored in your classroom? in your school building? Prove your answer.

LET'S PRACTISE

1.
$$\begin{array}{r} 391 \\ 476 \\ 836 \\ 894 \\ 687 \\ \underline{921} \end{array}$$

2.
$$\begin{array}{r} 18596 \\ \underline{-17489} \end{array}$$

3.
$$\begin{array}{r} 387 \\ \underline{\times 456} \end{array}$$

4. $33\overline{)\$68.64}$

5.
$$\begin{array}{r} 687 \\ \underline{\times 304} \end{array}$$

6. $76\overline{)7980}$

7. $656\overline{)57072}$

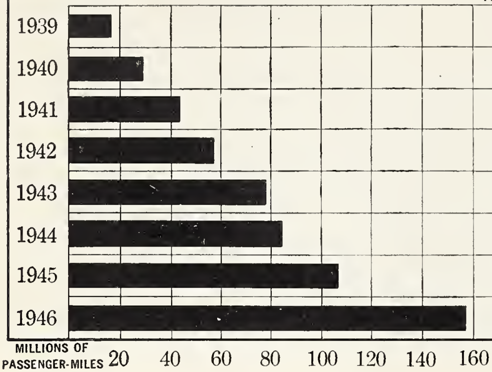
8. From 23,056 subtract 14,095.

9. Add 3 gal. 2 qt. and 5 gal. 3 qt.

10. Subtract 2 ft. 6 in. from 7 ft. 4 in.

GROWTH OF CANADIAN AVIATION

The figures show the revenue passenger-miles flown by Trans-Canada Planes and the number of passengers.



	PASSENGER-MILES	PASSENGERS
1939	16,096,000	28,759
1940	29,312,000	53,180
1941	44,248,000	85,154
1942	57,583,000	104,446
1943	78,508,000	140,276
1944	84,425,000	156,884
1945	106,425,000	183,121
1946	157,000,000	308,000

WE GROW AIR-MINDED

The graph shows the number of **passenger-miles** flown by land planes during an eight-year period. A passenger-mile is a mile flown by a plane with one passenger. Thus, if a plane contains 12 passengers and it flies 100 miles, it flies 1200 passenger-miles. (12 × 100)

1. Are the numbers given on the graph exact amounts or approximate amounts? If they are approximate amounts, to what degree of accuracy are they given?

2. Show that the number of passenger-miles flown by planes in 1946 was about 10 times as many as the number of passenger-miles flown in 1939.

3. Find the average number of miles per passenger in each year.

4. Does the average number of miles per passenger show any outstanding difference from year to year?

UNDERSTANDING LARGE NUMBERS

We speak of large numbers as millions or billions, and we can read such numbers easily. We know that a million is a thousand thousand; yet we cannot actually grasp the real meaning of such large numbers unless we use an illustration.

1. The distance to the sun is about 93,000,000 miles. Is this the exact or the approximate distance?

2. There are 60 minutes in an hour, 24 hours in a day, and 365$\frac{1}{4}$ days in a year. How many minutes are in a year?

3. Pretend you are travelling from the earth to the sun by airplane at the rate of 2 miles a minute. If you began the journey on January 1, 1900, would you have reached the sun? Would you have reached the sun if you had started January 1, 1860?

4. In a recent year, Canada's imports from Great Britain were valued at $140,517,488. Round off this amount to the nearest million dollars. How much more or less is the approximate figure than the exact amount?

5. The money spent by the Canadian Government during a recent year amounted to over $5,245,000,000. One newspaper reported that the government was spending $10,000 per minute. How close was the newspaper's estimate?

6. A silver dollar is about $\frac{1}{10}$ inches in thickness. Express in feet the height of a pile of silver dollars equal to the amount the newspaper said the government was spending in one minute.

★7. During the same year the total revenue of the Dominion Government was about $2,300,000,000. How did the government make up the difference between its revenue and expenditures?

OUR POTATO CROP

1. A bag of potatoes weighs 75 pounds. If a peck weighs 15 pounds, how many pecks are there in a bag? how many bushels?

2. If a farmer gets an average of $1.45 a bag for potatoes, how much does he get a peck? a bushel?

3. If potatoes are sold at the store for 30¢ a peck, how much more is that a bag than the price the farmer received? (problem 2)

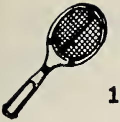
4. If a labourer earned $4.50 a day for picking potatoes at 5¢ a bag, how many bags did he fill?

5. A farmer grew an average of 156 bushels of potatoes to an acre. How many bags did he grow on 8 acres?

6. How many 75-pound bags can be filled from an acre which produces 140 bushels? (60 lb. = 1 bu.)

7. In a recent year 535,000 acres were planted to potatoes in this country. The average yield an acre was 150 bushels. How many bushels of potatoes were grown that year?

8. At an average price of $1.25 a bushel, find the value of the potato crop for the year given.



LET'S PRACTISE

1. $$\begin{array}{r} \$9.15 \\ 34.08 \\ 7.65 \\ 4.07 \\ 0.48 \\ \underline{12.98} \end{array}$$

2. $$\begin{array}{r} 70050 \\ \underline{-21187} \end{array}$$

3. $$\begin{array}{r} 963 \\ \underline{\times 408} \end{array}$$

4. $16\overline{)81125}$

5. $$\begin{array}{r} 960 \\ \underline{\times 780} \end{array}$$

6. $9\overline{)2112}$

7. $283\overline{)76405}$

8. How much greater than 3405 is 6000?
9. Multiply 9 lb. 3 oz. by 4.
10. Divide 14 ft. 8 in. by 2.
11. Find the product of 407 and 609.
12. From 4 bu. 2 pk. take 2 bu. 3 pk.
13. Find the sum of 601, 72, 649, 6, and 470.

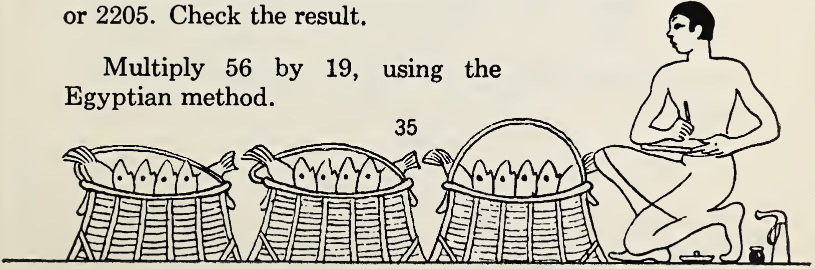
HOW THE EGYPTIANS MULTIPLIED FIGURES

The method we use for multiplying was not used by people many centuries ago. One of the earliest methods for multiplication was that used by the ancient Egyptians. By this method, it was not necessary to know any multiplication facts except the 2's, or the doubles. To multiply 63 by 35 by this method, the solution would be as shown.

1	63	✓
2	126	✓
4	252	
8	504	
16	1008	
32	2016	✓

The successive numbers in each column are doubled. Since 35 is equal to 32 + 2 + 1, the product of 35 and 63 is the sum of the numbers checked, or 63 + 126 + 2016, or 2205. Check the result.

Multiply 56 by 19, using the Egyptian method.



HOW WELL DO YOU REMEMBER?

1. About how many days were required to go from coast to coast in 1886? to-day?

2. What invention enabled man to make the greatest progress in fast transportation between two places?

3. About how many days were required by Howard Hughes to fly around the world? How does that time compare with the time required, about 1900, to make a round-the-world trip?

4. What is the best way to check addition? subtraction?

5. Name two ways to check multiplication; to check division.

6. What is meant by rounding off numbers?

7. Round off the following to the nearest thousand: *a.* 7632; *b.* 48,396; *c.* 7499; *d.* 58,502.

8. Copy and solve the following examples. Compare your work with that given and find the error in each example.

a.
$$\begin{array}{r}349\\ \times 6\\ \hline 1844\end{array}$$

b.
$$\begin{array}{r}703\\ \times 5\\ \hline 355\end{array}$$

c.
$$\begin{array}{r}704\\ -186\\ \hline 628\end{array}$$

d.
$$\begin{array}{r}403\\ -109\\ \hline 304\end{array}$$

e.
$$\begin{array}{r}324\\ \times 207\\ \hline 2268\\ 648\\ \hline 8748\end{array}$$

f.
$$\begin{array}{r}62\text{ r}4\\ 27\overline{)1468}\\ 162\\ \hline 48\\ 54\\ \hline 4\end{array}$$

g.
$$\begin{array}{r}62\ \ \text{r}5\\ 6\overline{)3725}\\ 36\\ \hline 12\\ 12\\ \hline 5\end{array}$$

Check
$$\begin{array}{r}62\\ 6\\ \hline 372\\ +5\\ \hline 3725\end{array}$$

9. Divide 217,125 by 472. Check the result by multiplication.

THINGS TO REMEMBER

1. *How transportation has changed in recent years.*

2. *The chief causes of errors in each of the four operations with whole numbers and how to correct them.*

3. *How to round off numbers.*

4. *The meaning of large numbers, such as a million.*

TEST ON CHAPTER I

1. What two inventions within the last 50 years enabled our country to make great progress in transportation? Which of these two inventions is more widely used to-day?

2. What is meant by the expression, "Horse and buggy era"?

3. About how long does it take to cross our country in a passenger plane?

4. Name some things which affect the cost of shipping freight by truck or railroad.

5. Jerry divided 3514 by 7 and had 52 for the result. He checked his work as shown. What should the quotient have been? Why is the check incorrect?

$$\begin{array}{r}52\\ \times 7\\ \hline 3514\end{array}$$

6. What is meant by rounding off numbers? Why are round numbers often used instead of exact numbers?

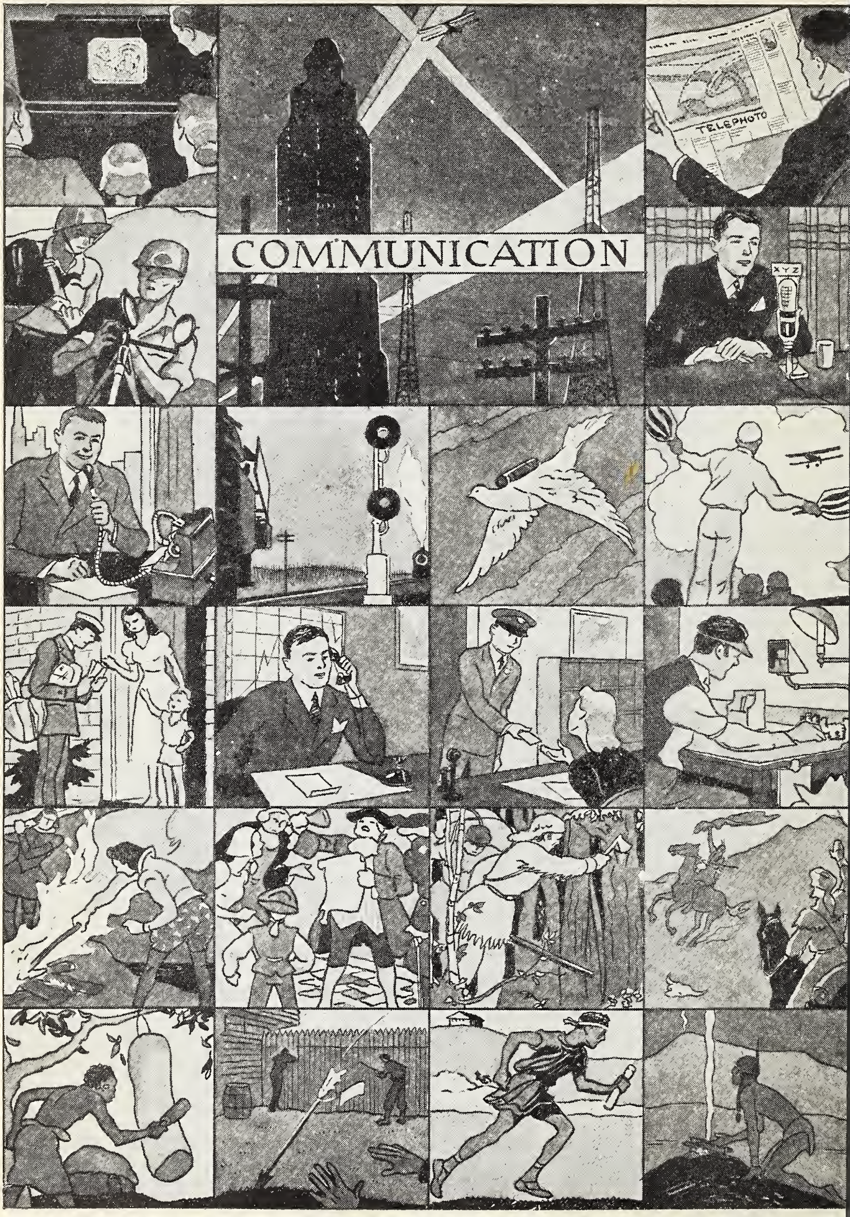
7. Round off the following numbers to the nearest ten thousand: *a*. 42,396; *b*. 178,529; *c*. 31,998; *d*. 299,750.

8. Give the place value of each figure in the number 46,012.

9. There are how many hundreds in the number 4681? how many tens? how many ones?

10. In one billion there are how many hundreds? how many thousands? how many millions?

TO A NEW CHAPTER


COMMUNICATION
TELEPHOTO
XYZ

CHAPTER II

RAPID COMMUNICATION

1. Six great inventions which have resulted in a rapid decrease in communication time are listed below:

Telegraph	1844	Radio Broadcasting	1920
Telephone	1876	Television	1927
Wireless	1896	Telecasting	1939

How many years have elapsed since each device was first used?

2. The first transcontinental telephone call on this continent was made in 1915. How long ago was that?

3. Radio waves travel at the speed of light (about 186,000 miles a second). How much farther than the distance around the earth at the Equator (25,000 miles) can a radio message travel in $\frac{1}{4}$ second? $\frac{1}{5}$ second?

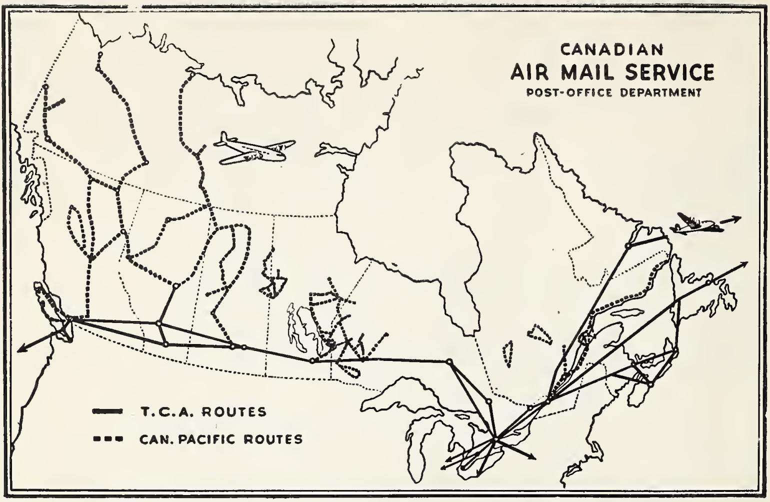
4. Mr. Brown is seated in a broadcasting station in London, England, 200 feet from the speaker. You are seated by your radio at home. Sound travels about 1120 feet a second. Prove that you hear each word of the broadcast before Mr. Brown hears it.

5. Give the shortest time required to transport a letter from Montreal to Vancouver in 1886 (page 10); the shortest time to-day. The time by train nowadays is how much longer than the time by plane?

*6. Give a brief report on either of the following problems:

a. What means of communication shown on page 38 were used to carry messages only for short distances?

b. Which of the forms of communication shown on page 38 are used most widely to-day?


CANADIAN
AIR MAIL SERVICE
POST-OFFICE DEPARTMENT
T.C.A. ROUTES
CAN. PACIFIC ROUTES

AIR MAIL—AIR EXPRESS—RAIL EXPRESS

1. A letter may be flown across Canada from coast to coast in less than one day. Twenty-five years ago the delivery of the letter would have taken at least 6 days. What has caused this great decrease in time?

2. Regular air mail service began with a Montreal to Vancouver flight on March 1, 1939. How long ago was that?

3. In 1939 air mail cost 6¢ for the first ounce and 5¢ for each additional ounce. Now the rate is 7¢ for the first ounce and 5¢ for each additional ounce. How much more must we now pay for a letter weighing 5 oz.?

4. The cost of sending a package by air express and by rail express between Winnipeg and Vancouver is as follows:

Weight	Air Express	Rail Express
1 lb.	$ .85	$ .20
2 lb.	1.40	.28
3 lb.	1.84	.40
4 lb.	2.28	.52
5 lb.	2.72	.64

Does each additional pound increase the cost by air express by the same amount? by rail express?

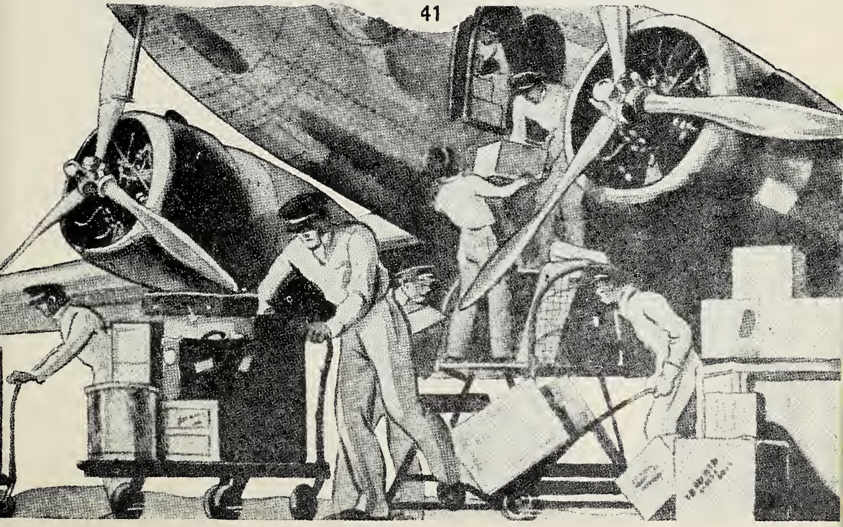
5. How much cheaper is it to send a 1-pound parcel by air mail than by air express between the two cities?

6. How much cheaper is it to send a 5-pound parcel by air express than by air mail at the rates given in problems **3** and **4**?

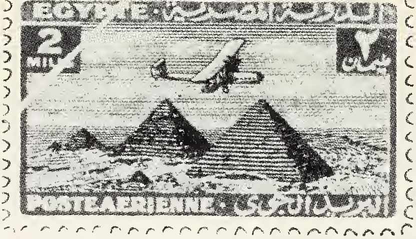
7. The cost of sending a 20-pound package by air express between Regina and Edmonton is $5.60; between Regina and Vancouver, $6.40. What is the cost by air mail, at the rates given in problem **3**, to send a 20-pound parcel between each pair of cities?

★8. Why were the costs for the two kinds of shipment between Regina and Edmonton and between Regina and Vancouver the same by air mail and different by air express?

★9. If a person on the Atlantic coast wished to communicate with another on the Pacific coast, under what conditions would it be advisable to telephone? to telegraph? to send an air mail letter? to send a letter by regular delivery?



AUSTRALIA
KOALA
4D
POSTAGE
4D



LIBERTAD
REPUBLICA DE CUBA
CORREOS

THE STAMP COLLECTOR

1. Postage stamps on mail matter were first used in Canada in 1851. How long ago was that?

2. Since 1867 about 225 different kinds of stamps have been issued by our Post Office Department. How many is that a year (on the average) between 1867 and the present time? (Many people collect these stamps. These collectors are called **philatelists.** Do you collect stamps as a hobby?)

3. The Canadian Bank Note Company manufactures about 6,000,000 stamps for each day in the year. What is the value of the daily output of stamps if the average value of each stamp is 3¢?

4. Find the total value of the stamps produced a year (365 days) at the rate and average value given in problem **3.**

5. The value of stamps sold in Canada during one year was $50,062,200. How much more or less was this than for the average year given in problem **4**?

***6.** Many collectors buy stamps through the Philatelic Section of the Post Office Department. Show how the Government profits by the Philatelic Section.

STUDY HELPS IN ADDITION OF FRACTIONS

Before you take the diagnostic test in addition of fractions (page 44), study the examples below. Then copy, and work them with your book closed. Compare your work with the work given.

1. $$\begin{array}{rcl} 5\frac{3}{4} & = & 5\frac{3}{4} \\ \underline{+2\frac{1}{2}} & = & \underline{2\frac{2}{4}} \\ & & 7\frac{5}{4} \;= \\ 7 + 1\frac{1}{4} & = & 8\frac{1}{4} \end{array}$$

Why is $2\frac{1}{2}$ changed to $2\frac{2}{4}$?
How do we change $\frac{5}{4}$ to $1\frac{1}{4}$?
How do we get $8\frac{1}{4}$?

2. Be ready to explain each step in the work below:

a. $$\begin{array}{rcl} 4\frac{3}{4} & & \\ \underline{+1\frac{1}{4}} & & \\ 5\frac{4}{4} & = & \\ 5 + 1 & = & 6 \end{array}$$

b. $$\begin{array}{rcl} 4\frac{5}{6} & = & 4\frac{5}{6} \\ \underline{+2\frac{2}{3}} & = & \underline{2\frac{4}{6}} \\ & & 6\frac{9}{6} \;= \\ 6 + 1\frac{3}{6} & = & 7\frac{1}{2} \end{array}$$

c. $$\begin{array}{rcl} 6\frac{1}{2} & = & 6\frac{4}{8} \\ \underline{+\ \frac{3}{8}} & = & \underline{\frac{3}{8}} \\ & & 6\frac{7}{8} \end{array}$$

3. How do you add two unlike fractions such as $\frac{1}{4}$ and $\frac{1}{3}$?

$$\begin{array}{rcl} \frac{1}{4} & = & \frac{3}{12} \\ \underline{+\frac{1}{3}} & = & \underline{\frac{4}{12}} \\ & & \frac{7}{12} \end{array}$$

Tell how to find the denominator, 12.
How do we change $\frac{1}{4}$ to $\frac{3}{12}$? $\frac{1}{3}$ to $\frac{4}{12}$?
Can $\frac{7}{12}$ be reduced?

4. Be ready to explain each step in the work below:

a. $$\begin{array}{rcl} 3\frac{1}{2} & = & 3\frac{3}{6} \\ \underline{+2\frac{2}{3}} & = & \underline{2\frac{4}{6}} \\ & & 5\frac{7}{6} = 5 + 1\frac{1}{6} = 6\frac{1}{6} \end{array}$$

b. $$\begin{array}{rcl} 3\frac{1}{4} & = & 3\frac{3}{12} \\ \underline{+2\frac{5}{6}} & = & \underline{2\frac{10}{12}} \\ & & 5\frac{13}{12} = 5 + 1\frac{1}{12} = 6\frac{1}{12} \end{array}$$

THINGS TO REMEMBER

Fractions must have the same denominator before their sum can be found. (See examples **1** and **2**.)

A common denominator of two or more unlike fractions is the product of their denominators. Find the sum of the numerators and write this sum over the common denominator. (See example **3**.)

Reduce all fractions in answer to lowest terms by dividing both numerator and denominator by the same number.

DIAGNOSTIC TEST IN ADDITION OF FRACTIONS

Part A (Like Fractions)

	a	*b*	*c*	*d*	*e*	*f*
I. (299)	$\frac{1}{5}$ $\frac{3}{5}$	$\frac{5}{8}$ $\frac{1}{8}$	$\frac{7}{9}$ $\frac{4}{9}$	$\frac{3}{8}$ $\frac{7}{8}$	$\frac{5}{8}$ $\frac{3}{8}$	$\frac{7}{12}$ $\frac{11}{12}$
II. (299)	$\frac{3}{8}$ $1\frac{5}{8}$	$4\frac{2}{5}$ $3\frac{1}{5}$	$\frac{4}{9}$ $2\frac{2}{9}$	$1\frac{3}{5}$ $3\frac{4}{5}$	$6\frac{1}{3}$ $\frac{2}{3}$	$1\frac{5}{6}$ $\frac{5}{6}$
III. (299)	$3\frac{1}{8}$ $1\frac{5}{8}$ $\frac{7}{8}$	$7\frac{5}{6}$ $\frac{5}{6}$ $1\frac{1}{6}$	$9\frac{1}{5}$ $\frac{4}{5}$ 6	$9\frac{3}{4}$ 7 $2\frac{3}{4}$	$6\frac{1}{12}$ $4\frac{7}{12}$ $8\frac{11}{12}$	$9\frac{1}{4}$ 4 $6\frac{3}{4}$

Part B (Unlike Fractions—Easy)

I. (299)	$\frac{5}{8}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{2}{3}$	$\frac{7}{12}$ $\frac{1}{4}$	$\frac{3}{5}$ $\frac{7}{10}$	$\frac{7}{8}$ $4\frac{1}{2}$	$7\frac{1}{2}$ $\frac{1}{6}$
II. (299)	$8\frac{3}{4}$ $\frac{1}{12}$	$3\frac{1}{6}$ $4\frac{1}{3}$	$9\frac{1}{2}$ $1\frac{3}{4}$	$8\frac{1}{2}$ $3\frac{5}{6}$	$12\frac{2}{3}$ $\frac{5}{6}$	$9\frac{5}{8}$ $7\frac{1}{4}$
III. (299)	$9\frac{1}{2}$ $4\frac{3}{4}$ $2\frac{5}{8}$	$4\frac{2}{3}$ $1\frac{1}{2}$ $7\frac{5}{6}$	$9\frac{5}{12}$ $\frac{3}{4}$ $1\frac{1}{2}$	$\frac{9}{16}$ $4\frac{3}{8}$ $9\frac{1}{2}$	$6\frac{1}{2}$ $\frac{3}{4}$ $7\frac{3}{16}$	$\frac{11}{12}$ $\frac{1}{3}$ $4\frac{5}{6}$

Part C (Unlike Fractions—Difficult)

I. (299)	$\frac{1}{2}$ $\frac{3}{5}$	$\frac{3}{4}$ $\frac{2}{3}$	$\frac{2}{3}$ $\frac{5}{8}$	$\frac{2}{3}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{6}$
II. (299)	$6\frac{1}{4}$ $1\frac{1}{3}$	$8\frac{1}{2}$ $2\frac{2}{3}$	$9\frac{1}{4}$ $1\frac{2}{3}$	$11\frac{1}{2}$ $4\frac{1}{5}$	$5\frac{1}{3}$ $1\frac{4}{5}$	$2\frac{5}{6}$ $1\frac{3}{4}$
III. (300)	$7\frac{1}{6}$ $2\frac{3}{4}$ 5	$9\frac{1}{4}$ $7\frac{1}{2}$ $2\frac{5}{6}$	$8\frac{1}{3}$ $4\frac{3}{4}$ $1\frac{1}{6}$	$\frac{3}{4}$ $\frac{5}{6}$ $7\frac{2}{3}$	$2\frac{3}{4}$ $1\frac{5}{6}$ $9\frac{1}{2}$	$\frac{5}{6}$ $\frac{3}{4}$ $1\frac{1}{2}$

If you make more than one error in any row, turn for practice to the key pages (in parentheses).

SENDING A MESSAGE BY TELEGRAPH

The cost of a telegraph message depends upon: its length; the distance sent; and the kind of message. There are a half dozen kinds of messages, of which the **telegram,** the **day letter,** and the **night letter** are most generally used.

For a regular telegram, there is a fixed charge for 10 words or less, and an added charge for each additional word. The table gives the rates for a regular telegram between Winnipeg and the following cities:

City	Rate for 10 Words or Fewer	Cost for Each Extra Word
Regina	$ .45	.03¢
Saskatoon	.60	.04¢
Edmonton	.75	.05¢
Vancouver	.85	.06¢

1. Find the cost of a 12-word telegram between Winnipeg and these cities: Saskatoon; Edmonton; Vancouver.

2. If a telegram between Winnipeg and Regina cost 90¢, how many words did it contain?

3. For all messages sent by telegraph, there has been added a government tax of 7 cents. Using that rate, find the total cost of each of the messages in problem **1.**

4. A telegram between Winnipeg and Vancouver cost $1.87, including the government tax. How many words did it contain?

***5.** What is a day letter? a night letter?

STUDY HELPS IN SUBTRACTION OF FRACTIONS

Before you take the diagnostic test in subtraction of fractions (page 47), study the examples below. Then copy, and work them with your book closed. Compare your work with the work given.

1. $$\begin{array}{rcrcl} 5\frac{1}{4} & = & 4\frac{5}{4} & & \\ -2\frac{3}{4} & = & 2\frac{3}{4} & & \\ \hline & & 2\frac{2}{4} & = & 2\frac{1}{2} \end{array}$$

Why was $5\frac{1}{4}$ changed to $4\frac{5}{4}$?
How do we change $5\frac{1}{4}$ to $4\frac{5}{4}$?
Why was $2\frac{3}{4}$ not changed?

2. Be ready to explain each step in the work below:

a. $$\begin{array}{rcl} 6\frac{3}{4} & & \\ -6\frac{1}{4} & & \\ \hline \frac{2}{4} & = & \frac{1}{2} \end{array}$$

b. $$\begin{array}{rcr} 7 & = & 6\frac{4}{4} \\ -2\frac{1}{4} & = & 2\frac{1}{4} \\ \hline & & 4\frac{3}{4} \end{array}$$

c. $$\begin{array}{rcr} 8\frac{1}{2} & = & 8\frac{2}{4} \\ -5\frac{1}{4} & = & 5\frac{1}{4} \\ \hline & & 3\frac{1}{4} \end{array}$$

3. How do you subtract $3\frac{1}{4}$ from $5\frac{2}{5}$?

$$\begin{array}{rcr} 5\frac{2}{5} & = & 5\frac{8}{20} \\ -3\frac{1}{4} & = & 3\frac{5}{20} \\ \hline & & 2\frac{3}{20} \end{array}$$

Why must both denominators be changed?
How do we find the 20?
Can $\frac{3}{20}$ be reduced?

4. Show that $1\frac{1}{4}$ equals $\frac{5}{4}$; that $4\frac{1}{2}$ equals $3\frac{6}{4}$.

5. Be ready to explain each step in the work below:

a. $$\begin{array}{rcrcr} 1\frac{1}{4} & = & 1\frac{3}{12} & = & \frac{15}{12} \\ -\frac{1}{3} & = & \frac{4}{12} & = & \frac{4}{12} \\ \hline & & & & \frac{11}{12} \end{array}$$

b. $$\begin{array}{rcrcr} 7\frac{1}{6} & = & 7\frac{4}{24} & = & 6\frac{28}{24} \\ -5\frac{7}{8} & = & 5\frac{21}{24} & = & 5\frac{21}{24} \\ \hline & & & & 1\frac{7}{24} \end{array}$$

6. Prove that the answer in the example at the right is correct. When is zero in the remainder (in subtraction of fractions) not written?

$$\begin{array}{r} 4\frac{2}{3} \\ -\frac{2}{3} \\ \hline 4 \end{array}$$

7. Explain the steps in working the example, $4\frac{1}{2} - 2\frac{2}{3}$.

8. What is the smallest common denominator of two fractions whose denominators are 6 and 8?

9. Jane subtracted $2\frac{1}{2}$ from $5\frac{1}{6}$ and had $2\frac{4}{6}$ for the result. What step did she omit in the solution?

DIAGNOSTIC TEST IN SUBTRACTION OF FRACTIONS

Subtract. Reduce the answers to lowest terms.

	a	*b*	*c*		*a*	*b*	*c*
I. (300)	$8\frac{4}{5}$ $3\frac{1}{5}$	$6\frac{3}{4}$ $2\frac{1}{4}$	$9\frac{7}{8}$ $9\frac{3}{8}$	**V.** (301)	$9\frac{1}{6}$ $4\frac{2}{3}$	$1\frac{1}{12}$ $\frac{5}{6}$	$2\frac{1}{2}$ $1\frac{3}{4}$
II. (300)	7 $2\frac{3}{4}$	1 $\frac{5}{6}$	6 $5\frac{7}{9}$	**VI.** (301)	$6\frac{1}{2}$ $4\frac{1}{3}$	$7\frac{2}{3}$ $5\frac{3}{4}$	$8\frac{1}{2}$ $7\frac{3}{5}$
III. (300)	$5\frac{1}{3}$ $2\frac{2}{3}$	$7\frac{1}{8}$ $2\frac{5}{8}$	$11\frac{1}{6}$ $10\frac{5}{6}$	**VII.** (301)	$6\frac{3}{4}$ $3\frac{1}{6}$	$1\frac{1}{6}$ $\frac{1}{4}$	$2\frac{5}{8}$ $\frac{5}{6}$
IV. (300)	$8\frac{1}{2}$ $2\frac{1}{4}$	$9\frac{3}{4}$ $6\frac{3}{8}$	$7\frac{5}{6}$ $7\frac{1}{6}$	**VIII.** (301)	$\frac{1}{2}$ $\frac{1}{2}$	$4\frac{2}{3}$ $\frac{2}{3}$	$6\frac{7}{8}$ $6\frac{1}{8}$

If you had more than one example incorrect in any of the eight groups above, review the study helps (page 46) before doing the practice exercises keyed to the test.

MAGIC SQUARES

$1\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{4}$	$1\frac{1}{12}$
$\frac{5}{12}$	$\frac{11}{12}$	$\frac{5}{6}$	$\frac{2}{3}$
$\frac{3}{4}$	$\frac{7}{12}$	$\frac{1}{2}$	1
$\frac{1}{3}$	$1\frac{1}{6}$	$1\frac{1}{4}$	$\frac{1}{12}$

1	$\frac{1}{8}$	?	?
?	$\frac{11}{16}$	$\frac{5}{8}$	$\frac{1}{2}$
?	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{3}{4}$
$\frac{1}{4}$	$\frac{7}{8}$	$\frac{15}{16}$	?

1. Find the sum of the numbers in each row and in each column of the square at the left.

2. Draw a square of 16 cells and copy in it the figures of the square at the right. Then fill in each empty cell with the correct figures so as to make a magic square.

STUDY HELPS IN MULTIPLICATION OF FRACTIONS

Before you take the diagnostic test in multiplication of fractions (page 49), study the examples below.

1. If the average weight of an apple is $\frac{3}{8}$ of a pound, how much does a dozen apples weigh?

$$12 \times \frac{3}{8} = \frac{12 \times 3}{8} = \frac{36}{8} = 4\frac{4}{8} = 4\frac{1}{2}$$

2. Explain each step in the following examples.

a. $4 \times \frac{1}{5} = \frac{4 \times 1}{5} = \frac{4}{5}$

b. $\frac{5}{6} \times 8 = \frac{5 \times 8}{6} = \frac{40}{6} = 6\frac{4}{6} = 6\frac{2}{3}$

Tell how to multiply a fraction by a whole number.

3. How much is $\frac{1}{2}$ of $\frac{1}{4}$?

$\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{2} \times \frac{1}{4} = \frac{1 \times 1}{2 \times 4} = \frac{1}{8}$ Can $\frac{1}{8}$ be reduced?

4. Study the examples and show that the work is correct.

a. $\frac{5}{6} \times \frac{2}{3} = \frac{5 \times 2}{6 \times 3} = \frac{10}{18} = \frac{5}{9}$

b. $\frac{3}{4} \times \frac{2}{3} = \frac{3 \times 2}{4 \times 3} = \frac{6}{12} = \frac{1}{2}$

Tell how to multiply a fraction by a fraction.

5. Show that $1\frac{2}{3} = \frac{5}{3}$. Show that $2\frac{1}{3} = \frac{7}{3}$. Tell how to change any mixed number to an improper fraction.

6. How much is $2\frac{1}{2} \times 4\frac{2}{5}$?

$2\frac{1}{2} \times 4\frac{2}{5} = \frac{5}{2} \times \frac{22}{5} =$

$\frac{5 \times 22}{2 \times 5} = \frac{110}{10} = 11$

How do we get the $\frac{5}{2}$? the $\frac{22}{5}$?
How do we get $\frac{110}{10}$?
How do we get the 11?

7. Study the examples and show that the work is correct.

a. $\frac{2}{3} \times 4\frac{2}{3} =$

$$\frac{2}{3}\times\frac{14}{3}=\frac{2\times 14}{3\times 3}=\frac{28}{9}=3\tfrac{1}{9}$$

b. $6\frac{2}{3} \times 4\frac{1}{2} =$

$$\frac{20}{3}\times\frac{9}{2}=\frac{\overset{10}{\cancel{20}}\times\overset{3}{\cancel{9}}}{\underset{1}{\cancel{3}}\times\underset{1}{\cancel{2}}}=30$$

8. By what numbers were both numerator and denominator divided in example 7*b*? The principle of **cancellation** was used. Explain what is meant by cancellation.

9. Tell how to multiply fractions and mixed numbers.

10. Copy examples 2, 4, and 7 without the "study helps" and multiply. Then compare your work with the work above.

DIAGNOSTIC TEST IN MULTIPLICATION OF FRACTIONS

		a	*b*	*c*	*d*
I.	(301)	$3\times\frac{1}{8}=?$	$3\times\frac{3}{10}=?$	$7\times\frac{5}{6}=?$	$9\times\frac{3}{4}=?$
II.	(301)	$4\times\frac{1}{6}=?$	$8\times\frac{5}{6}=?$	$9\times\frac{5}{12}=?$	$6\times\frac{7}{8}=?$
III.	(301)	$\frac{3}{7}\times 2=?$	$\frac{4}{7}\times 5=?$	$\frac{4}{5}\times 12=?$	$\frac{2}{3}\times 8=?$
IV.	(302)	$\frac{3}{8}\times 2=?$	$\frac{5}{6}\times 9=?$	$\frac{7}{12}\times 16=?$	$\frac{5}{8}\times 12=?$
V.	(302)	$\frac{3}{4}\times 20=?$	$12\times\frac{5}{6}=?$	$\frac{7}{8}\times 72=?$	$\frac{5}{6}\times 48=?$
VI.	(302)	$\frac{1}{2}\times\frac{3}{5}=?$	$\frac{2}{3}\times\frac{8}{9}=?$	$\frac{4}{5}\times\frac{3}{7}=?$	$\frac{2}{3}\times\frac{7}{9}=?$
VII.	(302)	$\frac{3}{4}\times\frac{5}{6}=?$	$\frac{9}{10}\times\frac{5}{6}=?$	$\frac{5}{9}\times\frac{3}{8}=?$	$\frac{7}{8}\times\frac{4}{5}=?$
VIII.	(302)	$3\frac{1}{2}\times 4\frac{2}{3}=?$	$\frac{3}{4}\times 3\frac{1}{3}=?$	$1\frac{7}{8}\times\frac{2}{3}=?$	$2\frac{1}{4}\times 5\frac{1}{6}=?$
IX.	(302)	12 $\underline{\times 3\frac{1}{6}}$	8 $\underline{\times 3\frac{2}{3}}$	$7\frac{3}{4}$ $\underline{\times 5}$	$26\frac{2}{3}$ $\underline{\times 9}$

If you missed more than one in any of the nine groups of examples, turn to pages 301–302 for practice exercises keyed to the test.

TWO WAYS OF COMPARING NUMBERS

John has a large camera which takes a 4″ × 5″ picture. This means that the picture is 4 inches wide and 5 inches long. The width can be compared with the length in two different ways.

a. The width is 1 inch less than the length. By this method, the numbers are compared by **subtraction.**

b. The width is $\frac{4}{5}$ as much as the length $(4 \div 5 = \frac{4}{5})$. By this method, the numbers are compared by **division. Comparison by division** is called finding the **ratio** of one number to another.

1. Compare 50¢ with 75¢ by subtraction.

2. Find the ratio of 50¢ to 75¢. THINK: $50 \div 75 = \frac{50}{75} = ?$

3. Find the ratio of the following:

a. 6 in. to 12 in.
b. 12 in. to 6 in.
c. 4 yd. to 6 yd.
d. 3 qt. to 1 gal.

4. Give two numbers which have a ratio of $\frac{1}{2}$; of $\frac{2}{3}$; of 3; of $\frac{5}{12}$; of $\frac{7}{8}$; of $\frac{5}{6}$; of $\frac{3}{4}$; of $\frac{5}{9}$.

5. A picture, 3″ × 4″, was enlarged to 9″ × 12″. What was the ratio of the dimensions of the original picture to the enlargement? of the enlargement to the original picture?

6. If John is 12 years old and his sister is 10 years old, what is the ratio of the sister's age to John's age? of John's age to his sister's age?

7. Find the ratio of:

a. 300 to 450
b. 125 to 175
c. 400 to 300
d. 510 to 630
e. 1500 to 2400
f. 3600 to 2400
**g.* $\frac{1}{2}$ to 2
**h.* $\frac{1}{4}$ to $\frac{1}{2}$
**i.* 1 to $\frac{1}{2}$

TALKING WIRES

Canada has about one two-hundredth of the world's population, but it has one thirtieth of the phones in the world.

1. For every 100 people in the world, there are 2 telephones; for every 100 people in Canada, there are 14.3 telephones. There are how many times as many telephones for 100 people in this country as in the world?

2. What is the ratio of the number of telephones to the number of people in this country? in the world?

3. The number of telephone messages sent in Canada in a recent year was 2,978,794,000. During the same year, the number of telegrams was 16,470,000, and the number of letters was 17,100,000. The number of messages sent by telephone is about how many times as great as the number sent by letter? by telegram?

4. The rates for a 3-minute person to person day call (less the government tax) between Winnipeg and certain cities were:

Regina	$1.65	Edmonton	$2.50
Saskatoon	2.10	Vancouver	3.20

Find the differences in these rates and the rates for a telegram between the same places. (See page 45.)

★5. Why are you willing to pay more for a telephone message than for a telegram?

★6. Why should the cost of a long-distance call between two places depend upon: *a.* the time of day; *b.* the length of the call; *c.* the distance between places?

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A CLASS PARTY

Here is a recipe for banana cake:

$2\frac{3}{4}$ cups sifted flour
2 teaspoons baking powder
1 teaspoon soda
$\frac{1}{4}$ teaspoon ground cloves
$1\frac{1}{2}$ teaspoons cinnamon
$\frac{3}{4}$ teaspoon nutmeg

$1\frac{1}{3}$ cups sugar
2 eggs, well beaten
$\frac{2}{3}$ cup shortening
2 teaspoons vanilla
$1\frac{2}{3}$ cups mashed bananas

1. How much flour was needed to make 3 cakes?

2. If 4 cups of flour equal one pound, find the number of pounds of flour used.

3. If 2 cups of granulated sugar equal 1 pound, how many pounds of sugar were used to make 3 cakes?

4. One cup of butter weighs $\frac{1}{2}$ pound. If butter was used for shortening, how much shortening was required?

5. If 5 bananas make $1\frac{2}{3}$ cups of mashed bananas, about how many bananas will it take to make 3 cakes?

6. Find the cost, to the nearest cent, of the following materials needed for the cakes:

Flour..........4¢ lb.
Sugar..........9¢ lb.

Butter.......42¢ lb.
Bananas.....60¢ doz.

FINDING QUOTIENTS BY MEASURING

Janet was one of a committee to decorate the gymnasium for a school party. She wanted to know how many pieces of ribbon, $\frac{2}{3}$ yard each, could be cut from a spool of ribbon containing 6 yards. She found the answer by measuring with a string.

1. Use a string, 6 yards long, and measure off pieces of string $\frac{2}{3}$ yard in length. You should get 9 pieces, each $\frac{2}{3}$ yard long. It follows that $6 \div \frac{2}{3} = 9$.

This same result can be found by multiplying 6 by $\frac{3}{2}$. Invert $\frac{2}{3}$ to make $\frac{3}{2}$. **To divide by a fraction, invert the fraction and multiply.** $6 \div \frac{2}{3} = 6 \times \frac{3}{2} = ?$

2. Robert said he did not understand this rule very well, but he knew that it worked. He reasoned as follows: "If each piece of ribbon were $\frac{1}{3}$ yard long, then 1 yard would make 3 pieces, and 6 yards would make 18 pieces. As the pieces are $\frac{2}{3}$ yard instead of $\frac{1}{3}$ yard in length, there will be just $\frac{1}{2}$ as many pieces as given for $\frac{1}{3}$ yard, or $\frac{1}{2}$ of 18, or 9." Why do you think Robert's reasoning was good?

3. Clyde thought as follows: "Since the denominator of the fraction is 3, the 6 should be changed to thirds. $6 = \frac{18}{3}$. Then the example is $\frac{18}{3} \div \frac{2}{3}$. As the two denominators are the same, I divide the two numerators, or $18 \div 2$, or 9. So the answer is 9." Why do you think Clyde was right?

*4. Divide 12 by $\frac{3}{4}$ by the method given by Robert (problem 2); by the method given by Clyde (problem 3).

STUDY HELPS IN DIVISION OF FRACTIONS

1. Study the examples below and explain each step in the work.

a. $4 \div \frac{2}{3} = ?$
$4 \times \frac{3}{2} = \frac{12}{2} = 6$

b. $6 \div \frac{4}{5} = ?$
$6 \times \frac{5}{4} = \frac{30}{4} = 7\frac{2}{4} = 7\frac{1}{2}$

2. What new step, if any, do you find in the work below?

a. $\frac{1}{2} \div \frac{1}{4} = ?$
$\frac{1}{2} \times \frac{4}{1} = \frac{4}{2} = 2$

b. $\frac{1}{6} \div \frac{2}{3} = ?$
$\frac{1}{6} \times \frac{3}{2} = \frac{3}{12} = \frac{1}{4}$

c. $\frac{4}{5} \div \frac{1}{2} = ?$
$\frac{4}{5} \times \frac{2}{1} = \frac{8}{5} = 1\frac{3}{5}$

3. How often will $8\frac{3}{4}$ contain $2\frac{1}{2}$?

$8\frac{3}{4} \div 2\frac{1}{2} = ?$

$\frac{35}{4} \div \frac{5}{2} = \frac{35}{4} \times \frac{2}{5} = \frac{70}{20} = 3\frac{1}{2}$

How do we get $\frac{5}{2}$? $\frac{35}{4}$?
Why do we invert $\frac{5}{2}$?

4. Show that the work below is correct.

a. $2\frac{1}{2} \div 7\frac{1}{2} = ?$
$\frac{5}{2} \div \frac{15}{2} = \frac{5}{2} \times \frac{2}{15} = \frac{10}{30} = \frac{1}{3}$

b. $5\frac{1}{4} \div 1\frac{3}{4} = ?$
$\frac{21}{4} \div \frac{7}{4} = \frac{21}{4} \times \frac{4}{7} = \frac{84}{28} = 3$

5. Copy examples **1** to **5** without the "study helps" and divide. Then compare your work with the work above.

6. Show that $8 \div 4$ is the same as $8 \times \frac{1}{4}$. What is the inverted form of 4? Is $6 \div 5$ the same as $6 \times \frac{1}{5}$?

7. Show that the work below is correct. Then copy the examples without the "study helps" and divide.

a. $3\frac{1}{4} \div 6 = ?$
$\frac{13}{4} \times \frac{1}{6} = \frac{13}{24}$

b. $\frac{3}{4} \div 2 = ?$
$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$

c. $5\frac{1}{3} \div 2 = ?$
$\frac{16}{3} \times \frac{1}{2} = \frac{16}{6} = 2\frac{2}{3}$

8. Tell each step in working the examples, $10\frac{1}{2} \div \frac{3}{4}$, and $2\frac{1}{4} \div 9$.

9. In what ways are multiplication and division of fractions alike?

DIAGNOSTIC TEST IN DIVISION OF FRACTIONS

	a	*b*	*c*	*d*
I. (303)	$4 \div \frac{1}{3} = ?$	$12 \div \frac{3}{4} = ?$	$15 \div \frac{3}{5} = ?$	$24 \div \frac{6}{7} = ?$
II. (303)	$6 \div \frac{4}{5} = ?$	$10 \div \frac{6}{7} = ?$	$12 \div \frac{9}{10} = ?$	$8 \div \frac{5}{6} = ?$
III. (303)	$5 \div 1\frac{1}{2} = ?$	$3 \div 3\frac{3}{4} = ?$	$10 \div 2\frac{1}{2} = ?$	$9 \div 1\frac{1}{4} = ?$
IV. (303)	$\frac{1}{2} \div \frac{2}{5} = ?$	$\frac{7}{8} \div \frac{3}{4} = ?$	$\frac{3}{4} \div \frac{4}{7} = ?$	$\frac{3}{4} \div \frac{3}{8} = ?$
V. (303)	$1\frac{1}{2} \div 4\frac{1}{2} = ?$	$5\frac{1}{4} \div 4\frac{1}{2} = ?$	$6\frac{2}{3} \div 4\frac{3}{4} = ?$	$7\frac{1}{2} \div 3\frac{3}{4} = ?$
VI. (303)	$8\frac{1}{2} \div \frac{2}{3} = ?$	$\frac{5}{6} \div 4\frac{1}{3} = ?$	$9\frac{1}{3} \div \frac{7}{9} = ?$	$\frac{1}{2} \div 3\frac{1}{4} = ?$
VII. (303)	$\frac{2}{3} \div 3 = ?$	$\frac{4}{5} \div 2 = ?$	$\frac{7}{8} \div 4 = ?$	$\frac{6}{7} \div 4 = ?$
VIII. (304)	$6\frac{1}{2} \div 2 = ?$	$1\frac{5}{7} \div 3 = ?$	$5\frac{1}{4} \div 4 = ?$	$3\frac{1}{8} \div 5 = ?$

If you had more than one example incorrect in any of the eight groups, review the study helps (page 54). Turn to pages 303–304 for practice exercises keyed to the test.

⋆TOPICS FOR SPECIAL REPORTS

1. What did Marconi do in the development of communication?
2. Arithmetic in a newspaper.
3. Show why the product of two proper fractions is less than either fraction.
4. If a proper fraction is divided by another proper fraction, the quotient is larger than the fraction divided. Show why.

SHRINKAGES IN CANNING

The Girls' Cooking Club visited a canning factory. They learned that most vegetables and fruits lose some of their bulk when canned. The table shows the measurements of some familiar products before and after canning.

PRODUCT	MEASUREMENT RAW	YIELD AFTER CANNING
Beans, String	4 pounds (about $\frac{1}{4}$ peck)	4 pints
Beets, Baby	2 pecks (about 25 pounds)	15 pints
Berries	$1\frac{1}{2}$ quarts	2 pints
Carrots	2 pecks (about 25 pounds)	15 pints
Cherries	$1\frac{1}{2}$ quarts	2 pints
Peaches	2 pecks	20 pints
Pears	8 or 10 halves	1 quart
Plums	$1\frac{1}{2}$ quarts	1 quart
Strawberries	1 quart	1 quart
Tomatoes	$1\frac{1}{2}$ quarts	1 quart

1. Which one of the products measures as much canned as raw?

2. A quarter peck of string beans will produce 4 pints of canned beans. How many pints are there in a quarter peck? How much is the loss due to canning?

3. About what is the weight of a bushel of string beans? How many pint jars would be needed to can these beans?

4. How many quarts of plums are needed to make 24 quarts of canned fruit?

5. Mrs. Drake wished to have 15 quarts of canned peaches. How many quarts of raw peaches must she have?

6. About how many quarts of canned tomatoes will a bushel of tomatoes make? (32 qt. = 1 bu.)

★A "TRUE AND FALSE" TEST

DIRECTIONS: Be prepared to tell which of the following statements are **true** and which are **false.** Give an illustration to show that your answer is correct.

SAMPLE: Both numerator and denominator of a fraction may be divided by the same number without changing the value of the fraction.

The statement is **true.** Illustration, $\frac{6}{8} = \frac{3}{4}$. Both numerator and denominator were divided by 2.

1. The same number may be added to both the numerator and the denominator of a fraction without changing the value of the fraction.

2. Both numerator and denominator of a fraction may be multiplied by the same number without changing the value of the fraction.

3. Multiplying only the numerator of a fraction by a number multiplies the fraction by that number.

4. The same number may be subtracted from both numerator and denominator without changing the value of the fraction.

5. Dividing only the denominator of a fraction by a number divides the fraction by that number.

6. If different fractions have the same numerator, the fraction which has the largest denominator is the largest.

7. If different fractions have the same denominator, the fraction which has the largest numerator is the largest.

8. Multiplying only the denominator of a fraction by a number multiplies the fraction by that number.

9. Dividing only the numerator of a fraction by a number divides the fraction by that number.

10. If 1 is divided by a fraction, the result will be the fraction inverted.

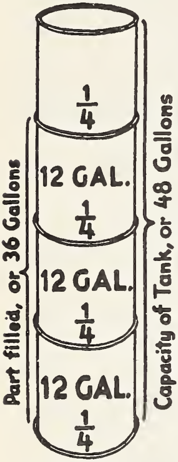
HOW MUCH WILL THE TANK HOLD?

1. If a tank, $\frac{3}{4}$ full, contains 36 gallons, how many gallons will it hold when full?

Think: "$\frac{3}{4}$ of the capacity = 36 gallons.

"Then $\frac{1}{4}$ of the capacity = 12 gallons ($\frac{1}{3}$ of 36 gallons); and $\frac{4}{4}$ of the capacity = 48 gallons (4 × 12 gallons)." The tank will hold 48 gallons when full.

Robert made a diagram to help him find the capacity of the tank.



a. Into how many parts is the diagram divided?

b. How many of the parts represent the number of gallons there are in the tank?

c. How do you find the number of gallons represented by one part of the diagram?

d. If you know how many gallons one part represents, how can you find the capacity of the tank?

e. If the tank were $\frac{2}{3}$ full, into how many parts would a diagram be divided to represent the capacity of the tank?

f. How many of the parts (problem *e*) would represent 36 gallons?

g. How many gallons would one of the parts in problem *f* represent?

2. If a car travels 42 miles in $\frac{3}{4}$ hour, find the rate an hour.

Find the number when:

3. $\frac{3}{4}$ of it = 72
4. $\frac{7}{8}$ of it = 35
5. $\frac{4}{9}$ of it = 36
6. $\frac{1}{3}$ of it = 65
7. $\frac{5}{6}$ of it = 30
8. $\frac{3}{8}$ of it = 27
9. $\frac{4}{5}$ of it = 48
10. $\frac{9}{10}$ of it = 45
11. $\frac{1}{2}$ of it = 17
12. $\frac{5}{6}$ of it = 25
13. $\frac{2}{3}$ of it = 54
14. $\frac{4}{9}$ of it = 45

A PART IS KNOWN, FIND ALL

1. If $\frac{1}{2}$ pound of candy costs 35¢, what is the cost a pound?

2. One third of a class went on a picnic. If there were 28 who went to the picnic, how many were in the class?

3. If $\frac{3}{4}$ of a pound of butter costs 33¢, what is the cost a pound?

4. If $\frac{2}{3}$ of a yard of velvet costs $1.20, find the cost a yard.

5. Mrs. Martin bought two lamb chops weighing 10 ounces ($\frac{5}{8}$ lb.) for 20¢. At that rate, what is the cost a pound?

6. An automobile manufacturer advertised that one of his cars was sold every $\frac{2}{3}$ of a minute. At that rate, how many cars were sold in one hour? in one day of 24 hours? in one year of 365$\frac{1}{4}$ days?

7. A tank, $\frac{3}{8}$ full, contained 750 gallons of gasoline. What was the capacity of the tank?

8. The subscription to a magazine was offered for $2.40, or $\frac{3}{5}$ of the regular price. What was the regular price?

9. The cost of construction of $\frac{3}{8}$ of a mile of concrete road was $27,450. At that rate, find the cost of construction of one mile.

10. If the cost of 14 ounces ($\frac{7}{8}$ lb.) of steak is 35¢, what is the cost of one pound?

★11. It is estimated that 3 out of 100 families in this country have a yearly income of at least $5000. If there are 63,000 families which have an income of this amount, how many families are there in this country?

★12. Using the result from problem **11**, how many families in this country have a yearly income of less than $5000?

LET'S PRACTISE

Practise one set of examples at a time. If you need more practice, work the same set several times. Keep a record of your scores to see how much your work improves.

Set I

1. $\begin{array}{r}376\\9058\\467\\39\\758\\905\\\hline\end{array}$

2. $\begin{array}{r}70030\\-20437\\\hline\end{array}$

3. $\begin{array}{r}638\\\times 27\\\hline\end{array}$

4. $9\overline{)3121}$

5. $16\overline{)8120}$

6. $372\overline{)21095}$

7. $\begin{array}{r}1\frac{3}{4}\\2\frac{5}{8}\\7\frac{1}{2}\\9\frac{7}{8}\\\hline\end{array}$

8. $\frac{3}{4}-\frac{1}{3}=?$

9. $8\times\frac{7}{10}=?$

10. $6\div\frac{9}{10}=?$

11. $\frac{5}{8}\times 36=?$

Set II

1. $\begin{array}{r}905\\378\\690\\154\\738\\86\\\hline\end{array}$

2. $\begin{array}{r}53109\\-3734\\\hline\end{array}$

3. $\begin{array}{r}547\\\times 308\\\hline\end{array}$

4. $\begin{array}{r}6\text{ ft. }9\text{ in.}\\+3\text{ ft. }5\text{ in.}\\\hline\end{array}$

5. $\begin{array}{r}7\text{ lb. }\ \ 5\text{ oz.}\\-4\text{ lb. }10\text{ oz.}\\\hline\end{array}$

6. $\begin{array}{r}9\frac{7}{12}\\2\frac{1}{4}\\\frac{5}{6}\\3\frac{1}{2}\\8\frac{2}{3}\\\hline\end{array}$

7. $14\overline{)71271}$

8. $11\frac{1}{2}-3\frac{5}{8}=?$

9. $36\times 4\frac{1}{2}=?$

10. $9\frac{1}{4}\div 4=?$

Set III

1. $\begin{array}{r}138\\905\\467\\50\\1492\\709\\\hline\end{array}$

2. $\begin{array}{r}31425\\-30856\\\hline\end{array}$

3. $\begin{array}{r}907\\\times 408\\\hline\end{array}$

4. $\begin{array}{r}5\text{ ft. }4\text{ in.}\\\times 3\\\hline\end{array}$

5. $\begin{array}{r}13\text{ yd. }1\text{ ft.}\\-5\text{ yd. }2\text{ ft.}\\\hline\end{array}$

6. $\begin{array}{r}4\frac{1}{2}\\7\frac{1}{3}\\2\frac{5}{6}\\3\frac{3}{4}\\8\frac{7}{12}\\\hline\end{array}$

7. $238\overline{)11424}$

8. $13\frac{2}{3}-7\frac{5}{6}=?$

9. $\frac{3}{8}\times 7\frac{1}{4}=?$

10. $72\div\frac{3}{8}=?$

HOW WELL DO YOU REMEMBER?

1. What are the fastest ways of sending written communications? Explain how each may be used.

2. How many of the means of communication studied in this chapter are less than 100 years old? less than 50 years old?

3. Name two sound-carrying inventions. About what date was each invention?

4. Name some of the things which add to the cost of a telegram; of a long-distance call by telephone.

5. Give two illustrations of like fractions; of unlike fractions.

6. Find the smallest common denominator for fractions having denominators of: *a*. 2, 3, and 4; *b*. 2, 4, and 6; *c*. 3, 6, and 8; *d*. 6, 8, and 12.

7. Give a rule for multiplying one fraction by another; for dividing one fraction by another.

8. Multiply $\frac{3}{4}$ by $\frac{3}{8}$; divide $\frac{3}{4}$ by $\frac{3}{8}$.

9. Copy the sentence and supply the missing word: If a number is divided by a proper fraction, the quotient will always be (?) than the number. Why?

10. Find the ratio of: *a*. 3 in. to 6 in.; *b*. 4 oz. to 12 oz.; *c*. 12 oz. to 4 oz.; *d*. 8 oz. to 1 lb.; *e*. 12 ft. to 16 ft.

11. What is the ratio of 25¢ to one dollar?

12. If one number is twice as large as another, what is the ratio of the smaller number to the larger?

13. Find a number when: *a*. $\frac{3}{4}$ of it = 27; *b*. $\frac{2}{3}$ of it = 72; *c*. $\frac{5}{6}$ of it = 120; *d*. $\frac{7}{8}$ of it = 56; *e*. $\frac{4}{9}$ of it = 42.

14. If $\frac{3}{4}$ yard of cloth costs 48¢, what is the cost of one yard?

15. If an airplane can fly at the rate of a mile in $\frac{2}{5}$ minute, what is its speed an hour?

THINGS TO REMEMBER

1. *Some of the rapid means of communication.*
2. *How to add, subtract, multiply, and divide fractions.*
3. *How to find the ratio of two numbers.*
4. *How to find a number when a fractional part of it is known.*

TEST ON CHAPTER II

1. What rapid means of communication was invented in the twentieth century? in the nineteenth century?

2. The cost of a telegram between two cities is 48¢ for 10 words and $3\frac{1}{2}$¢ for each additional word. What is the cost to send a telegram of 18 words between these two cities?

3. If the cost of a telegram between the two cities was 55¢, how many words were in the message (see problem 2)?

4. Give an illustration of the following: *a.* a fraction expressed in lowest terms; *b.* a mixed number; *c.* like fractions; *d.* unlike fractions.

5. Solve the following: *a.* $7\frac{1}{2} + 9\frac{2}{3}$; *b.* $6\frac{1}{4} - 3\frac{5}{6}$; *c.* $7\frac{1}{3} \times 4\frac{1}{2}$; *d.* $12\frac{3}{4} \div 4\frac{1}{2}$; *e.* $6 \div 2\frac{2}{3}$; *f.* $8 \times 26\frac{3}{4}$.

6. What is the lowest common denominator for fractions having denominators of: *a.* 4 and 12? *b.* 4 and 6? *c.* 6 and 8? *d.* 2, 3, and 4? *e.* 3, 4, and 8?

7. What is the ratio of 2 inches to 6 inches?

8. Give two numbers which have a ratio of $\frac{1}{2}$.

9. Find the number when: *a.* $\frac{2}{3}$ of it $= 18$; *b.* $\frac{4}{5}$ of it $= 20$; *c.* $\frac{3}{8}$ of it $= 60$; *d.* $\frac{3}{7}$ of it $= 21$; $\frac{5}{8}$ of it $= 27$.

10. If an airplane travels 120 miles in $\frac{3}{4}$ hour, at that rate how far will it travel in one hour?

TO A NEW CHAPTER

CHAPTER III

OUR DECIMAL SYSTEM OF NUMBER

One of the important symbols in our number system is zero. It has been used only about 1000 years. Before zero was known, ancient peoples had other devices for computing. One of these was the **abacus.** The beads on the first rod represent ones; on the second rod, tens; on the third rod, hundreds; and on the fourth rod, thousands.

1. How many rods would be needed on an abacus to represent ten thousands? ten millions?

2. To represent the number, 405, five beads would be moved on the ones' rod and four beads on the hundreds' rod. Why would there be no beads moved on the tens' rod? How would 320 be shown on the abacus?

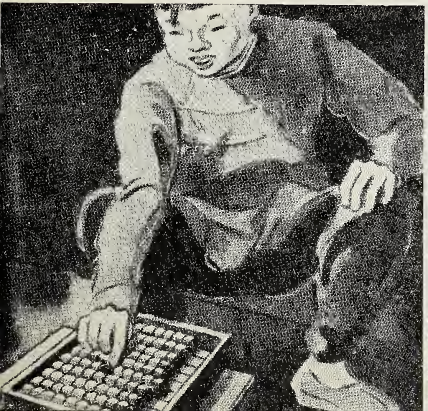
3. Do you need zero to represent a figure on an abacus?

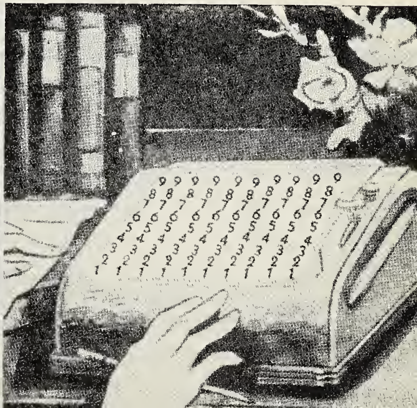
4. How could you represent 100 on an abacus?

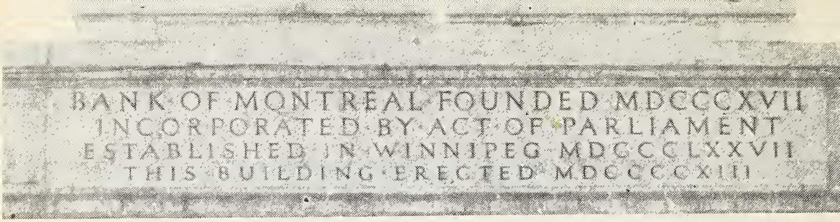
Today we use many different kinds of calculating machines as aids in computation. Find the row of 9's on the calculator in the picture, 8's, and so on down to ones.

5. Does the keyboard of the calculating machine have a row of 0's?

6. How would you show 400 on the calculating machine?






BANK OF MONTREAL FOUNDED MDCCCXVII
INCORPORATED BY ACT OF PARLIAMENT
ESTABLISHED IN WINNIPEG MDCCCLXXVII
THIS BUILDING ERECTED MDCCCCXIII

THE ROMAN NUMBER SYSTEM

1. What are the dates on the building shown in the accompanying picture?

2. Why were these dates used?

The following symbols, as you recall, are used in the Roman number system:

I = 1
V = 5
IV = 4
X = 10
L = 50
XL = 40
C = 100
D = 500
CD = 400
M = 1000
CM = 900

3. What does III represent in the Roman number system?

4. What does 111 represent in our number system?

5. If our number system did not have place value, what number would be represented by 111?

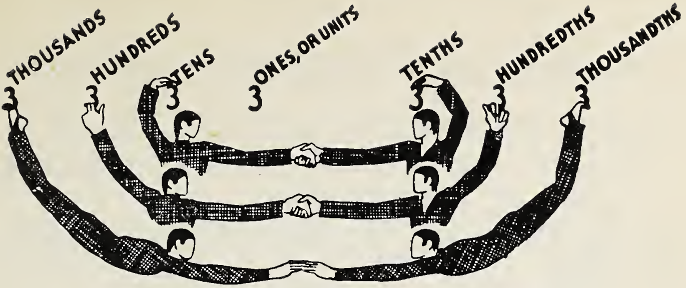
6. Explain the chief differences between our system of number and the Roman system.

7. Using Roman symbols, write the following: *a.* 110; *b.* 56; *c.* 768; *d.* 909; *e.* 1123; *f.* 2000.

8. Use Roman symbols to write the year of Confederation; the present year. Find the difference between these dates. Check the result by using our numbers.

9. Show how our number system is more convenient than the Roman system.

*10. What is the chief purpose of zero in our number system?



MORE ABOUT PLACE VALUE

1. In the number 33, as you have learned, there are 3 tens and 3 ones. The value of each figure is its **place value.** Give the place value of each figure in the number 333.333.

2. Starting at the decimal point, each succeeding place to the left has a place value how many times the next place to the right?

3. Reading from right to left, a figure has a place value equal to what part of the value of the next place to its left?

4. Does moving a figure one place to the right increase or decrease the value of that figure? How much is the increase or decrease?

The first place to the right of the decimal point represents tenths, the second place to the right of the decimal point represents hundredths, the third place to the right of the decimal point represents thousandths.

5. What place represents ten thousandths? hundred thousandths?

6. Write a number which contains six places on each side of the decimal point. Name each place.

7. How are the places to the right and left of the ones' place related?

STUDY HELPS IN ADDITION OF DECIMALS

1. How much is 3.8 feet and 4.6 feet?

$$\begin{array}{r} 3.8 \text{ ft.} \\ \underline{4.6 \text{ ft.}} \\ 8.4 \text{ ft.} \end{array}$$

Since tenths are added, there will be tenths (or zero) in the answer.

2. Prove by working the examples that the sums below are correct:

a.	*b.*	*c.*	*d.*	*e.*
3.74	.7	.02	23.487	.045
1.28	.3	.03	6.004	.038
5.02	1.0	.05	29.491	.083

In how many of the examples was the result expressed in thousandths? in hundredths? in tenths?

3. Find the sum of 4.6 and 3.75.

$$\begin{array}{r} 4.60 \\ \underline{3.75} \\ 8.35 \end{array}$$

Express .6 as hundredths before adding. Thus, 4.6 = 4.60.

Annexing zeros to the right of a decimal point does not change the value of a number. Thus, .4 = .40 = .400. Does .30 = .3?

4. Explain how to add 4.7 and 5.84.

5. In the following example change each number to thousandths, then add: 3.4 + 3 + .34 + .034.

READING AND WRITING DECIMALS

1. Tell how to change a decimal to a common fraction.

2. Change the following decimals to common fractions: *a.* .3; *b.* .17; *c.* 1.39; *d.* .456.

3. Write as decimals: *a.* $\frac{9}{10}$, *b.* $\frac{23}{100}$, *c.* $\frac{149}{1000}$, *d.* $3\frac{1}{10}$, *e.* $9\frac{41}{100}$.

4. Write as decimals: *a.* three hundredths; *b.* five thousandths; *c.* one ten thousandth.

5. Read the following decimals: *a.* .7; *b.* .006; *c.* 3.45: *d.* 2.005; *e.* .365.

6. Write one millionth as a decimal.

DIAGNOSTIC TEST IN ADDITION OF DECIMALS

This test will help you to find the steps in addition of decimals in which you need more practice.

	a	*b*	*c*		*a*	*b*	*c*
I.	.2	.7	.8	**IV.**	3.86	8.65	7.64
(304)	.3	.9	.4	(304)	4.27	97.84	0.02
	.1	.6	.8		9.81	0.52	1.03
II.	5.6	99.5	376.3	**V.**	.038	.484	.003
(304)	8.4	8.4	18.7	(304)	.496	.673	.002
	7.3	37.2	9.0		.184	.482	.005
III.	.94	.14	.08	**VI.**	9.764	86.495	0.795
(304)	.82	.23	.03	(305)	0.031	0.009	2.652
	.65	.56	.02		0.596	0.273	0.008

VII. (305) Add 9.7, 8.65, and .38.

If you had more than one example incorrect in any group, turn to pages 304–305 for keyed practice exercises.

STUDY HELPS IN SUBTRACTION OF DECIMALS

1. Prove, by working the following examples, that the remainders are correct.

a.	*b.*	*c.*	*d.*	*e.*
12.4	26.45	5.16	.675	.46
9.5	8.76	5.08	.375	.42
2.9	17.69	0.08	.300	.04

2. In the following examples zeros were annexed to get the same number of places in each number. Prove, by working the examples, that the remainders are correct.

a. 78.6 − 28.75 = ?

78.60
28.75
49.85

How many zeros were annexed to 78.6?

b. 29.625 − 18.45 = ?

29.625
18.450
11.175

Why was a zero annexed to 18.45?

DIAGNOSTIC TEST IN SUBTRACTION OF DECIMALS

This test will help you to find the steps in subtraction of decimals in which you need more practice.

	a	*b*	*c*		*a*	*b*	*c*
I.	.9	.8	.6	**IV.**	9.75	8.03	12.10
(305)	.5	.3	.4	(305)	0.64	1.52	8.04
II.	9.8	5.1	46.5	**V.**	.375	.965	.013
(305)	2.7	4.2	3.0	(305)	.143	.947	.007
III.	.56	.27	.08	**VI.**	8.754	21.625	9.472
(305)	.28	.23	.02	(306)	0.008	8.425	0.029

VII. (306) Subtract 9.75 from 24.1.

If you had more than one example incorrect in any group, turn to pages 305–306 for keyed practice exercises.

COMPARING DECIMALS AND FRACTIONS

1. Arrange the following decimals in order of size: .1, .7, .42, .036, 1.1, .375.

To compare decimals or fractions, express them as decimals or fractions having the same denominator. In this example, each decimal should be expressed as thousandths. Thus, .1 = .100; .7 = .700; .42 = .420; .036 = .036; 1.1 = 1.100; .375 = .375. Now arrange the decimals according to their size.

Arrange the following decimals or fractions in order of size from smallest to largest:

2.	.7	.97	.07	7.1	.275	.018
3.	.25	2.53	.050	.205	2.5	.025
4.	.009	.012	.9	.85	9	.09
5.	.075	.08	7.5	7.45	75	.75
6.	$\frac{7}{10}$	.04	.8	.91	3.2	$\frac{27}{100}$
7.	.6	.025	$\frac{19}{100}$	.27	.003	$\frac{1}{10}$

LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE

LAKE ELEVATION

This table shows the elevation above sea-level of each of the Great Lakes.

LAKE	ELEVATION
Superior	602.23 ft.
Michigan	580.77 ft.
Huron	580.77 ft.
St. Clair	575.30 ft.
Erie	572.40 ft.
Ontario	245.88 ft.

1. What is the difference in elevation between the highest and the lowest of the Great Lakes?

2. How much higher is Lake Erie than Lake Ontario? Lake Huron than Lake Erie? Lake Superior than Lake St. Clair?

3. What is the difference in elevation between Lake Huron and Lake Ontario?

*4. Find the elevations of three lakes in your province and compare these elevations with those of the highest and the lowest of the Great Lakes.

*5. What feat of modern engineering makes it possible for ships to proceed from Lake Ontario to Lake Erie?

STUDY HELPS—MULTIPLICATION OF DECIMALS

1. Mr. Baker knows that his car averages 20.6 miles to a gallon of gasoline. If he buys 6.3 gallons, how far should he be able to travel before refilling his tank?

$$\begin{array}{r} 20.6 \\ \underline{6.3} \\ 618 \\ \underline{1236} \\ 129.78 \end{array}$$

Think, "20.6 is about 21, and 6.3 is about 6. As 6 × 21 = 126, he should travel about 126 miles." How many miles did he travel?

There is one decimal place in the number multiplied and one in the multiplier. The sum of these is the number of decimal places in the product.

To multiply decimals: **Multiply as in whole numbers. Then point off as many decimal places in the product as there are places in the two numbers being multiplied.**

2. Prove, by working the following examples, that the rule for placing the decimal points has been applied correctly.

a. 3.7	*b.* .4	*c.* 1.3	*d.* .46	*e.* .15	*f.* 25
×5	×.8	×.7	×.2	×.05	.07
18.5	.32	.91	.092	.0075	1.75

3. Why was the zero inserted between the decimal point and the 9 in example *d*? Why were the two zeros inserted between the decimal point and the 7 in example *e*?

	a	*b*	*c*	*d*
4.	.9 × .8 = ?	6 × 3.8 = ?	.1 × 7.5 = ?	10 × 3.7 = ?
5.	2 × .6 = ?	15 × 3.5 = ?	.86 × 6 = ?	100 × 48.56 = ?
6.	.6 × .74 = ?	.25 × .25 = ?	.1 × .1 = ?	1000 × 5.863 = ?

7. Milton multiplied .2 by .2 and had .04 for the product. He thought that his answer was wrong because .04 is smaller than .2. Was his answer correct? Why?

PLACING THE POINT IN THE PRODUCT

In the following examples, the products are given with decimal points omitted. Copy the products and insert the decimal points. In some examples you must insert zero between the point and the first figure of the product.

1. 3.14 × 2.5 = 7850
2. 1.1 × 6.8 = 748
3. 75 × 4.5 = 3375
4. 4.2 × 1.8 = 756
5. .17 × .36 = 612
6. 48 × .056 = 2688
7. .1 × 1.6 = 16
8. .5 × .06 = 30
9. 9 × .01 = 9
10. .34 × 8.5 = 2890
11. .9 × 1.01 = 909
12. 7.5 × .075 = 5625

From each of the following groups of products, select the one which seems most nearly correct.

13. 2.5 × 3.1 = .775; 7.75; 77.5

THINK, "2.5 is between 2 and 3; 3.1 is between 3 and 4. Therefore, 2 × 3, or 6, is the smallest possible product and 3 × 4, or 12, is the largest possible product. So the product must be between 6 and 12, or 7.75."

14. 5 × 3.14 = 157; 15.7; 1.57
15. 2.1 × .21 = .441; 4.41; .0441
16. 3.5 × .35 = 12.25; 1.225; .1225
17. 4.1 × 5.2 = 213.2; 2.132; 21.32
18. .15 × .25 = .375; 3.75; .0375
19. 6 × 1.5 × 2.1 = 189; 1.89; 18.9
20. .3 × 10 × 74 = 222; 22.2; 2.22

*21. 1.2 × 1.2 × 1.2 = 17.28; 1.728; .1728

*22. 30 × .4 × 2.5 = 300; 3.00; 30.00

*23. 3.14 × 8 × .8 = 2009.6; 200.96; 20.096

*24. 3.6 × .1 × 3.1 = .1116; 1.116; 11.16

*25. 2.5 × .7 × 1.1 = .1925; 1.925; 19.25

USING A TIME-TABLE

Use the time-table to find the answers to the questions below.

Read Down			Read Up
No. 7	Miles	TABLE 268	No. 8
P. M.			A M.
11.55	0.0	Regina	6.20
6.40 Ar. 9.10 Lv.	161.9	Saskatoon	Lv. 11.57 Ar. 8.30
9.35	175.5	Warman	8.05
9.45	179.4	Osler	7.57
10.09	190.6	Hague	7.38
10.34	201.7	Rosthern	7.11
10.58	213.2	Duck Lake	6.46
11.32	230.4	Macdowall	6.11
12.15	249.0	Prince Albert	5.30
P. M.			P. M.

1. What is the number of the time-table? What is the number of the train travelling from Regina to Prince Albert? from Prince Albert to Regina?

2. How many miles is it from Regina to Saskatoon? from Saskatoon to Prince Albert?

3. How long does it take train No. 7 to go from Regina to Saskatoon? from Saskatoon to Prince Albert?

4. How long does it take train No. 8 to go from Prince Albert to Saskatoon? from Saskatoon to Regina?

5. Standard fare in most of Canada is 3.45 cents a mile. At that rate what is the fare for a trip of 15 miles?

6. At the rate of 3.45 cents a mile, how much would be the fare from Regina to Saskatoon?

7. At the rate of 3.45 cents a mile, find the fare from Warman to Rosthern; from Duck Lake to Prince Albert.

8. In Western Canada beyond Edson, Alberta, the fare is 4.0 cents a mile. From Edson to Jasper, the distance is 106.2 miles. Find the fare at the rate of 4.0 cents a mile.

9. From Jasper to Vancouver the distance is 534.9 miles. Find the fare at the rate of 4.0 cents a mile.

10. On a certain day, train No. 8 is 70 minutes late. At what time does it arrive at Macdowall?

*11. From a time-table find the distances from your home to some important cities, the times of departure and return, and the times required to make the trips. Compute the fares at the rates given in problems 5 and 8.

DIAGNOSTIC TEST IN MULTIPLICATION OF DECIMALS

Copy and multiply the following decimals:

	a	*b*	*c*		*a*	*b*	*c*
I. (306)	.3 4	3.6 7	.934 5	**V.** (307)	.2 .3	.21 .1	.02 .2
II. (306)	25 .7	54 2.3	79 4.2	**VI.** (307)	.034 .2	.712 .03	.305 .25
III. (306)	1.4 .6	3.25 .2	47.9 .6	**VII.** (307)	.375 1.4	4.06 .014	5.37 .006
IV. (306)	.3 .4	.5 .5	.47 .6	**VIII.** (307)	3.7 10	4.687 100	29.46 1000

If you misplaced any of the decimal points in the answers to these examples, check your work with the Study Helps—Multiplication of Decimals (page 70). Then turn to pages 306–307 for practice exercises keyed to the test examples which you missed.

GREETING CA

ANY CHRISTMAS CARDS TO-DAY?

Bob sells Christmas cards as a part-time job. He orders from the printer in lots of 1000 because he can get a better price than by buying smaller quantities.

1. One lot of a thousand cards cost Bob $19.50. What was the average cost a card?

THINK: $19.50 = 1950 cents   1950 ÷ 1000 = ?

2. Had he ordered by the hundred, the cost of each lot would have been $2.10. How much a card was that?

3. How much more was the average cost of one card when bought by the hundred than by the thousand?

4. Bob sold the cards in boxes of 20 at 85¢ a box. If the boxes cost him 30¢ a dozen, how much did he earn from the sale of 1000 cards (cost price $19.50 a thousand)?

5. Find the cost of 100 cards at:

a. 3.2¢ each   *b.* 1.7¢ each   *c.* .95¢ each

6. Find the cost of 1000 cards at:

a. 1.75¢ each   *b.* 2.4¢ each   *c.* .78¢ each

7. Multiply each number by 10; 100; 1000:

a. 7   *b.* 5.6   *c.* 1.453   *d.* 46.5   *e.* 34.75   *f.* 1.065

8. Divide each number in problem 7 by 10; 100; 1000.

MULTIPLYING AND DIVIDING BY 10, 100, OR 1000

Notice how the decimal point is moved in each of the examples below. Then copy and work the examples.

$10 \times 3.14 = 31.4$ $\quad$ $1000 \times 3.85 = 3850$
$100 \times 4.56 = 456$ $\quad$ $1000 \times 3.1416 = 3141.6$

To multiply a decimal by 10, 100, or 1000, move the decimal point as many places to the right as there are zeros in the multiplier.

1. Multiply the following numbers by 10:
a. 96; *b*. .5; *c*. 75.4; *d*. .806; *e*. 73.45; *f*. .1; *g*. .04.

2. Multiply the following numbers by 100:
a. 1.45; *b*. .9; *c*. 3.56; *d*. .458; *e*. 7.6; *f*. .041; *g*. 6.5; *h*. 3.04.

3. Multiply the following numbers by 1000:
a. 4.8; *b*. .32; *c*. .005; *d*. 6.75; *e*. 1.915; *f*. .1; *g*. .04; *h*. 9.3.

4. The number 4.5 must be multiplied by 10 to make it 45. By what must 3.25 be multiplied to make it 325?

5. What is the smallest number each of the following decimals must be multiplied by to make the result a whole number:
a. .7; *b*. .15; *c*. 3.4; *d*. .546; *e*. 1.05; *f*. 1.673.

6. Note how the decimal point is moved in each example. Then copy and work the examples.

a. $4.5 \div 10 = .45$; *b*. $9.85 \div 100 = .0985$; *c*. $3.2 \div 1000 = .0032$; *d*. $3.76 \div 10 = .376$; *e*. $31.5 \div 1000 = .0315$.

To divide a decimal by 10, 100, or 1000, move the decimal point as many places to the left as there are zeros in the divisor.

7. Divide each of the following numbers by 10; by 100; by 1000:
a. 7.4; *b*. .3; *c*. 1.45; *d*. 5.6; *e*. 32.5; *f*. 769.1; *g*. .05.

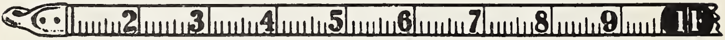
DIFFERENT KINDS OF RULERS

1. An inch is what part of a foot?

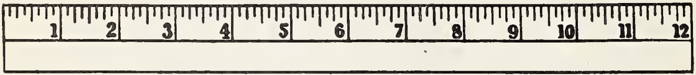
2. Which is longer, an inch or a tenth of a foot?

3. How many eighth inches are in a foot?

4. Each tenth of a foot in the surveyor's chain is divided into 10 equal parts. What is the length of each division?



A one-foot section of surveyor's chain tape (above) compared with an ordinary foot rule (below).



5. Which is greater, $\frac{1}{8}$ of an inch or $\frac{1}{100}$ of a foot?

6. If the top of your teacher's desk is 3 feet 6 inches, or $3\frac{1}{2}$ feet long, the length may be written as 3.5 feet. Show that 3.5 is the same as $3\frac{1}{2}$. Think, "$3.5 = 3\frac{5}{10} = ?$"

7. If the top of your desk is 2 feet 3 inches, or $2\frac{1}{4}$ feet long, the length may be written as 2.25 feet. Show that 2.25 feet is the same as $2\frac{1}{4}$ feet.

You found by **reduction** that .25 foot is the same as $\frac{1}{4}$ foot. The work shows how a common fraction may be changed to a decimal fraction of the same value.

$$\begin{array}{r} .25 \\ \frac{1}{4} = 4\overline{)1.00} \\ \underline{8} \\ 20 \\ \underline{20} \end{array}$$

To change a common fraction to a decimal fraction, put a decimal point after the numerator and annex zeros. Then divide by the denominator.

8. Change the following to decimals. Then show by reduction to fractions that your work is correct: *a.* $\frac{3}{4}$; *b.* $\frac{2}{5}$; *c.* $\frac{1}{8}$; *d.* $\frac{5}{8}$; *e.* $\frac{3}{5}$; *f.* $\frac{7}{8}$; *g.* $\frac{1}{5}$; *h.* $\frac{1}{2}$; *i.* $\frac{4}{5}$; *j.* $\frac{3}{8}$.

9. Express as common fractions reduced to lowest terms: *a.* .75; *b.* .6; *c.* .125; *d.* .625.

ROUNDING OFF THE RESULT

1. Mr. Clark made a trip of 250 miles in 7 hours. What was his average speed an hour?

$$\begin{array}{r}
35.71\\
7\overline{)250.00}\\
\underline{21}\\
40\\
\underline{35}\\
50\\
\underline{49}\\
10\\
\underline{7}\\
3
\end{array}$$

The exact rate an hour can not be found as a decimal. Mr. Clark, however, wants to know his speed only to the nearest mile; or to the nearest tenth of a mile.

His average speed to the nearest mile was 36 miles an hour; to the nearest tenth, 35.7 miles an hour. This is called **rounding off.**

A decimal may be rounded off just as a whole number may be. To round off a decimal in a quotient:

a. **Carry the quotient to one more place than will be kept in the result.**

b. **If the figure in the place to be dropped is 5 or more, increase the figure to the left by one.**

c. **If the figure in the place to be dropped is less than 5, drop it. Do not change the figure to the left.**

2. Here are several illustrations of rounding off decimals:

7.46 to the nearest tenth is 7.5. Why is the 4 changed to 5?
.249 to the nearest tenth is .2. Why is the 2 not changed to 3?
.444 to the nearest tenth is .4. Why?

3. Round off the following to the nearest tenth:

a. .37; *b.* 1.14; *c.* 3.349; *d.* .607; *e.* .95; *f.* 9.95.

4. Round off the following to the nearest hundredth:

a. 3.142; *b.* .5449; *c.* .675; *d.* 9.995; *e.* .095.

5. Round off the following to the nearest hundred:

a. 736; *b.* 9625; *c.* 4875; *d.* 3550; *e.* 9950.

DECIMAL VALUES OF COMMON FRACTIONS

The decimal value of the common fraction $\frac{3}{4}$ is .75, as you know. A common fraction of this kind has an **exact decimal value.**

The exact decimal value of some other common fractions, as you recall, cannot be found. For these fractions an **approximate value** is expressed by rounding off the decimal value to the nearest tenth, hundredth, and so on.

1. Find the decimal value of the fraction $\frac{5}{6}$ to the nearest hundredth.

$$\begin{array}{r} .833 \\ 6\overline{)5.000} \\ \underline{4\,8} \\ 20 \\ \underline{18} \\ 20 \\ \underline{18} \end{array}$$

Why was the quotient carried to three decimal places?

How many places would there be in the quotient if the result were to be expressed to the nearest tenth?

.833 to the nearest hundredth is .83.

To find the approximate decimal value of a common fraction you have learned to:

a. **Annex zeros to the numerator and divide this number by the denominator.**

b. **Carry the quotient to one more place than the number of places to be kept in the result.**

c. **Round off the quotient to the number of places desired.**

2. Find the decimal value of the following fractions to the nearest tenth:

a. $\frac{1}{3}$ *b.* $\frac{3}{8}$ *c.* $\frac{5}{16}$ *d.* $\frac{4}{9}$ *e.* $\frac{9}{16}$ *f.* $\frac{2}{3}$ *g.* $\frac{8}{9}$ *h.* $\frac{3}{4}$

3. Find the decimal value of the following fractions to the nearest hundredth:

a. $\frac{1}{7}$ *b.* $\frac{1}{3}$ *c.* $\frac{4}{9}$ *d.* $\frac{2}{3}$ *e.* $\frac{1}{6}$ *f.* $\frac{7}{9}$ *g.* $\frac{3}{8}$ *h.* $\frac{5}{8}$

RANKING BASEBALL CLUBS

1. If the City Park High School baseball team won 11 games and lost 3 games, what was the team's standing?

```
      .7857
14)11.0000
    9 8
    1 20
    1 12
        80
        70
       100
        98
         2
```

If 11 games were won and 3 games were lost, 14 games were played.

The ratio of the number of games won to the number of games played is $\frac{11}{14}$.

The team standing is .786.

Why was the 5 in .7857 changed to 6?

2. In a recent season, Western High School won 8 baseball games and lost 3, while Portage High School won 9 games and lost 4. Which team had the better standing?

The figures below give certain records of National and American League teams about midseason.

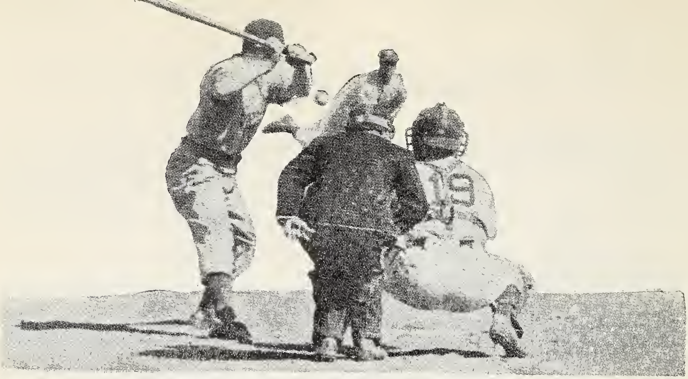
NATIONAL LEAGUE

CLUB	WON	LOST	PER CENT
Chicago	46	31	.597
New York	44	33	?
St. Louis	43	33	?
Pittsburgh	41	35	?
Cincinnati	37	40	?
Brooklyn	35	42	?
Boston	33	43	?
Philadelphia	27	49	?

AMERICAN LEAGUE

CLUB	WON	LOST	PER CENT
New York	50	25	.667
Boston	42	35	?
Detroit	40	35	?
Chicago	41	36	?
Cleveland	39	37	?
Washington	36	39	?
Philadelphia	30	45	?
St. Louis	28	48	?

3. Find the standing of each team, correct to three decimal places.



THE STAR OF THE TEAM

Batting averages, like the standing of baseball teams, are usually expressed as 3-place decimals (corrected from four places). Why are 3-place decimals used for batting averages in preference to 2-place decimals?

Batting averages are found by dividing the number of hits a player made by the number of times he was at bat.

Here are the batting records of the five leading hitters on the City Park School team.

BATTER	AT BAT	HITS
Jim	72	26
Tony	83	32
Red	68	21
Mike	59	17
Luke	78	29

1. Find the batting average of each boy.

2. How much higher was Tony's average than Luke's? than Red's?

3. Rank the batters according to average.

★4. Lou Gehrig played in 2130 consecutive games for the New York "Yankees." He was at bat 7941 times and made 2696 hits. What was his batting average for these games?

★5. In the major leagues a "300 hitter" is considered good. This means that the player has a batting average of .300 or better. How much more or less than a "300 hitter" would a player be if he got 153 hits out of 500 times at bat?

★THE INTERESTING NUMBER SEVEN

The exact decimal value of a fraction, such as $\frac{1}{3}$ and $\frac{1}{7}$, cannot be found. $\frac{1}{3}$ = .3333...... This kind of decimal is called a **recurring decimal.**

The decimal value for a fraction having a denominator of 7 is a recurring decimal. If you examine the decimal values of $\frac{1}{7}$, $\frac{2}{7}$, $\frac{3}{7}$, as given, you will see that the same numbers occur in each, but in a different order. These same numbers also recur in the decimal values for $\frac{4}{7}$, $\frac{5}{7}$, and $\frac{6}{7}$.

$\frac{1}{7}$ = .142857...
$\frac{2}{7}$ = .285714...
$\frac{3}{7}$ = .428571...

1. Find, by examining the $\frac{1}{7}$, $\frac{2}{7}$, $\frac{3}{7}$ series, the recurring decimal values for the fractions $\frac{4}{7}$; $\frac{5}{7}$; $\frac{6}{7}$. Then check each decimal value by division.

2. Multiply .142857 by 7. How much less than 1 is this product? Why is the product not exactly 1?

3. Multiply 37037 by 21.

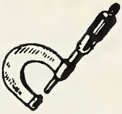
4. Paul said, "My favorite number is 7. That is why I like the example 63 × 12345679." Multiply these numbers and see why Paul liked this example.

5. Ancient people often mentioned the "Seven Seas" and the "Seven Planets." Are there exactly seven seas? more or less? Are there just seven planets? more or less?

6. What were the seven ancient wonders of the world? How many of them are still in existence?

7. Milton found this puzzle problem: "You may add, subtract, multiply, or divide and get a result of 50 by using four 7's. Show how it may be done." (See solution on page 124).

EVERYDAY USES OF DECIMALS



1. The size of an automobile tire is 5.50 × 16. Tell what these dimensions mean.

2. Milk weighs 10.22 pounds a gallon. How much more or less than 1 pound does a pint of milk weigh?

3. The average yearly rainfall in Manitoba is 20.45 inches. How much more or less is this than a monthly average of $1\frac{3}{4}$ inches?

4. Machinists use the micrometer for measuring to the nearest thousandth of an inch. If the diameter of a bolt is .498 inches, how much more or less than half an inch is the diameter of the bolt?

5. Malcolm Campbell set a motorboat record of 141.74 miles an hour. Is that more or less than an average of $2\frac{1}{3}$ miles a minute?

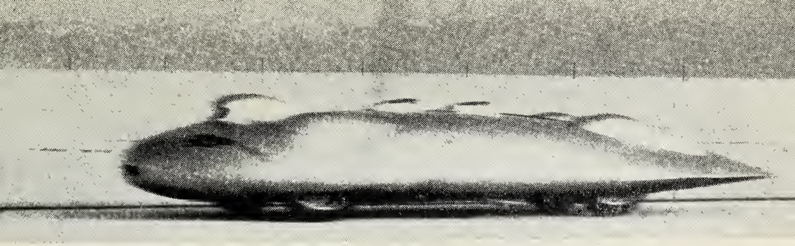
6. A baseball player had a batting average of .347 for the season. Did he make more or less than one hit to each three times at bat?

7. Show that our money system is a decimal system, that our system of weights (ounce, pound, ton) is not a decimal system.

★8. Card catalogues in most libraries use the Dewey Decimal System. Find what is meant by this system.

★9. Bring to class at least two other uses of decimal fractions.

★10. Find the average yearly amount of rainfall for your home city or town.



THE FASTEST THING ON WHEELS

1. Cobb drove the Red Lion over a measured mile on the salt flats of Bonneville, Utah, at an average rate of 368.85 miles an hour. How many miles a minute is this?

2. The previous record for speed on land was 357.5 miles an hour. How much greater was Cobb's record than the former record?

*3. The Red Lion travelled the mile in one direction at an average of 370.75 miles an hour. On the return trip, the speed was 366.97 miles an hour. What was the average rate for the two miles?

*4. Cobb's time for the mile in one direction was 9.71 seconds and in the return trip, 9.81 seconds. What was the average time for the two miles?

READING AND WRITING DECIMALS

1. Read the following decimals: *a.* .26; *b.* 3.7; *c.* .125; *d.* .001; *e.* 2.005.

2. Write the following with numbers: *a.* three tenths; *b.* seven and six tenths; *c.* forty-five hundredths; *d.* fifteen thousandths.

3. For greater accuracy in reading decimals, among business people the decimal point is read as "point" and each figure is read without its place value. Thus, 3.48 is read, "3-point-4-8." Read each of the following by this method: *a.* 3.1416; *b.* .037; *c.* 1.006; *d.* 12.315; *e.* 14.072; *f.* 0.4938.

MAKING THE DIVISOR A WHOLE NUMBER

In any division example, as you have learned, both the divisor and the number divided may be multiplied by the same number without changing the value of the quotient. Thus, in the example $3\overline{)15}$, if both 3 and 15 are multiplied by 10, the resulting example is $30\overline{)150}$. The quotients to both examples, $3\overline{)15}$ and $30\overline{)150}$, are the same, 5.

When dividing by a decimal it is usually easier to change the divisor to a whole number by multiplying both divisor and number divided by 10, 100, or 1000.

.4 can be made a whole number by multiplying it by 10.

$$10 \times .4 = 4$$

1. What is the smallest number by which each of the following must be multiplied to make it a whole number? *a.* .3; *b.* 4.5; *c.* .75; *d.* 3.14; *e.* .625; *f.* 1.075.

If the divisor is multiplied by 10, 100, or 1000, the dividend must be multiplied by this same number. Study the examples and then solve them.

$.4\overline{).72} = 4\overline{)7.2}$ Multiplying each number by 10.

$.6\overline{).732} = 6\overline{)7.32}$ Multiplying each number by 10.

$.25\overline{).375} = 25\overline{)37.5}$ Multiplying each number by 100.

2. What is the smallest number by which both the divisor and the number divided must be multiplied in order that the divisor will be a whole number?

a. $.3\overline{).24}$ *c.* $.7\overline{)8.4}$ *e.* $.25\overline{).175}$ *g.* $.04\overline{)7.2}$

b. $.9\overline{).819}$ *d.* $.6\overline{)40.8}$ *f.* $.36\overline{)1.44}$ *h.* $7.5\overline{)3}$

3. Show how each of the following changes was made:

a. $1.6\overline{)9.6} = 16\overline{)96}$ *b.* $1.5\overline{)6} = 15\overline{)60}$ *c.* $.25\overline{).625} = 25\overline{)62.5}$

THE ORIGINAL ZEPHYR

1. On a non-stop trip of 1015 miles between Denver and Chicago, the Zephyr (original stainless-steel, streamlined railroad train) covered the distance in 13.1 hours. Show that the average speed was about 77.5 miles an hour.

2. The Zephyr weighed 254,000 pounds. How many tons is that?

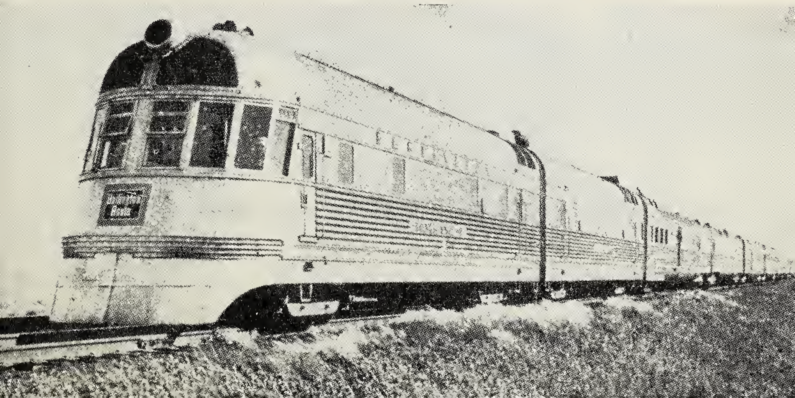
3. Stainless-steel trains are about one third as heavy as ordinary steel trains. What would be the weight of a train made from ordinary steel of a size corresponding to that of the Zephyr?

4. The comparison of operation costs a mile for steam and Zephyr trains is shown in the following table:

	ZEPHYR TRAINS	STEAM TRAINS
Maintenance of power plant or locomotive	$0.0505	$0.1830
Maintenance of train	0.0399	0.1020
Cost of fuel oil, or coal	0.0139	0.1085
Cost of lubricating oil and water	0.0093	0.0140
Wages of crew	0.1735	0.2240
Train supplies and expenses	0.0271	0.0640

What is the total cost a mile for operating each kind of train?

5. Find the difference in cost to operate each kind of train between Denver and Chicago.



DIVIDING BY A DECIMAL

1. Bob had a board, 9 feet long, which he wished to saw into lengths of 1.5 feet. He measured the number of pieces he could get and found that there would be 6. Then he knew that 9 ÷ 1.5 = 6.

$$1.5\overline{)9} = \begin{array}{r}6\\15\overline{)90}\end{array}$$

To clear the decimal point in the divisor, multiply 1.5 by 10.

Why was the dividend also multiplied by 10?

To divide by a decimal:

a. **Make the divisor a whole number by multiplying by 10, 100, or 1000.**

b. **Multiply the dividend by the same number by which the divisor was multiplied.**

c. **Place the decimal point in the quotient directly above the decimal point in the number divided.**

In the following examples, the quotient figures are given but the decimal points are missing. Copy each example and supply the missing decimal point.

	a	*b*	*c*	*d*	*e*
2.	$\begin{array}{r}52\\7\overline{)3.64}\end{array}$	$\begin{array}{r}24\\9\overline{).216}\end{array}$	$\begin{array}{r}15\\15\overline{)2.25}\end{array}$	$\begin{array}{r}31\\24\overline{).744}\end{array}$	$\begin{array}{r}5\\.15\overline{)75}\end{array}$
3.	$\begin{array}{r}7\\.3\overline{).21}\end{array}$	$\begin{array}{r}46\\.2\overline{)9.2}\end{array}$	$\begin{array}{r}16\\.14\overline{).224}\end{array}$	$\begin{array}{r}12\\3.1\overline{).372}\end{array}$	$\begin{array}{r}3\\.14\overline{)4.2}\end{array}$
4.	$\begin{array}{r}13\\.05\overline{).65}\end{array}$	$\begin{array}{r}73\\.7\overline{)51.1}\end{array}$	$\begin{array}{r}36\\3.6\overline{).1296}\end{array}$	$\begin{array}{r}12\\.18\overline{).216}\end{array}$	$\begin{array}{r}12\\.08\overline{)9.6}\end{array}$
5.	$\begin{array}{r}54\\1.1\overline{)5.94}\end{array}$	$\begin{array}{r}17\\.21\overline{).357}\end{array}$	$\begin{array}{r}7\\9.2\overline{).644}\end{array}$	$\begin{array}{r}16\\.52\overline{).0832}\end{array}$	$\begin{array}{r}5\\.17\overline{)8.5}\end{array}$

EVERYDAY USES OF DECIMALS

1. The Canadian 3-cent postage stamp is .75 inch by .87 inch. Stamps come in sheets of 100 with 10 stamps on a side. Find the dimensions of a sheet of these stamps (do not consider space for perforation).

2. A certain stamp is .84 inch by 1.44 inches. Find the dimensions (not considering space for perforation) of a sheet of these stamps.

3. A gallon of milk weighs 10.22 pounds and a gallon of water 10.00 pounds. To the nearest tenth of a pound, what is the weight of a pint of milk? of a pint of water?

4. A metre is equal to 39.37 inches. There are 100 centimetres in a metre. What is the length of a centimetre? Round off the result to the nearest tenth of an inch.

DIVIDING DECIMALS

	a	*b*	*c*	*d*
1.	$.9\overline{)8.1}$	$.6\overline{)7.2}$	$27\overline{).81}$	$1.5\overline{)75}$
2.	$.07\overline{)6.3}$	$4\overline{).096}$	$1.2\overline{)2.16}$	$.18\overline{)36}$
3.	$3.3\overline{)858}$	$.85\overline{)2.465}$	$72\overline{)2.808}$	$1.6\overline{).0256}$
4.	$8.4\overline{)38.64}$	$3.8\overline{)186.2}$	$.76\overline{)4.408}$	$3.5\overline{)420}$
5.	$.88\overline{)4.928}$	$3.6\overline{)2124}$	$68\overline{)45.56}$	$2.4\overline{).0576}$
6.	$16\overline{)9}$	$12\overline{)15}$	$24\overline{)108}$	$32\overline{)150}$
7.	$.05\overline{)41}$	$2.3\overline{)874}$	$47\overline{).0564}$	$1.3\overline{).377}$
8.	$10.2\overline{)2.142}$	$.102\overline{).2142}$	$1.02\overline{).2142}$	$1.02\overline{)21.42}$
9.	$102\overline{).2142}$	$.102\overline{)2.142}$	$10.2\overline{)21.42}$	$102\overline{)2.142}$

DENOMINATE NUMBERS TO DECIMALS

The record transatlantic crossing by steamer from Southampton, England, to New York City, a distance (as reckoned by steamship lines) of 2938 miles, was 3 days, 20 hours, 42 minutes. What was the average rate an hour?

3 days = 72 hours
20 hours = 20 hours (given)
$\overline{92}$ hours

$$42 \text{ min.} = \frac{42}{60} \text{ hr.}$$

$$\frac{42}{60} = \frac{7}{10} = .7$$

Total time = 92.7 hours

$$92.7\overline{)2938} = 927\overset{31.69}{\overline{)29380.00}}$$

To the nearest tenth of a mile, the average rate was 31.7 miles an hour.

To multiply and divide by denominate numbers, change them to fractional or decimal form.

1. Copy and work the above example using decimals as shown. Then work it using fractions ($2938 \div 92\frac{7}{10}$). Which method is easier?

2. The fastest eastward crossing of the Atlantic by steamer was 3 days, 22 hours, 7 minutes. Show that this time, to the nearest hundredth of an hour, is 94.12 hours.

3. Show that 8 feet 5 inches, to the nearest hundredth of a foot, is equal to 8.42 feet.

Copy and change each of the following examples to the nearest hundredth of the unit indicated:

	a	*b*
4.	5 hr. 15 min. = ? hr.	4 da. 8 hr. = ? da.
5.	6 ft. 4 in. = ? ft.	8 gal. 1 qt. = ? gal.
6.	8 min. 45 sec. = ? min.	16 min. 55 sec. = ? min.
7.	5 yd. 2 ft. = ? yd.	3 lb. 10 oz. = ? lb.
8.	9 lb. 12 oz. = ? lb.	2 yr. 4 mo. = ? yr.

ESTIMATING THE RESULT

In the following examples you are to choose the answer which approximates most closely the result. Do not solve the example, but use judgment in making your choice. Study the sample

SAMPLE: 48 × 2.3 = 1100; 960; 100; 464

THINK: "As 48 is almost 50 and 2.3 is about 2, the product of these two numbers should be about 100. Therefore, 100 is the approximate answer."

1. .98 × 37 = 356; 3.5; 35; 42
2. 12.68 ÷ 12 = 1; 11; 10.4; 9.8
3. 76 − 15.48 = 50; 60; 55; 550
4. 45.2 × 3.78 = 250; 1500; 150; 225
5. 365 ÷ .09 = 36; 365; 3650; 400
6. 72.5 × 2.45 = 100; 150; 1440; 250
7. 1.856 ÷ 2.5 = .5; 4; 40; 60
8. 98.045 − 47.36 = 40; 50; 60; 75
9. 96 × 7.465 = 60; 600; 70; 700

LET'S PRACTISE

⑤

1. $\begin{array}{r} 675 \\ 1238 \\ 906 \\ 84 \\ 537 \\ 729 \\ \hline \end{array}$

2. $\begin{array}{r} 31096 \\ -15408 \\ \hline \end{array}$

3. $\begin{array}{r} 26\frac{3}{4} \\ -15\frac{7}{8} \\ \hline \end{array}$

4. $\begin{array}{r} 376 \\ \times 209 \\ \hline \end{array}$

5. $\begin{array}{r} 9.25 \\ \times .38 \\ \hline \end{array}$

6. $\begin{array}{r} 7\frac{2}{3} \\ 1\frac{5}{6} \\ 8\frac{3}{4} \\ 9\frac{1}{2} \\ 2\frac{1}{6} \\ \hline \end{array}$

7. $4\frac{1}{2} \times 4\frac{1}{4} = ?$ **9.** $.738 - .056 = ?$ **11.** $4.575 \div .05 = ?$

8. $\frac{3}{4} \div 2\frac{1}{2} = ?$ **10.** $3718 \div 18 = ?$ **12.** $9235 \div 165 = ?$

13. Round off the following to the nearest thousand:
a. 7389; *b.* 54,500; *c.* 9971; *d.* 40,700

14. Round off the following to the nearest hundredth:
a. .564; *b.* .3449; *c.* .485; *d.* .996; *e.* 1.094

DIAGNOSTIC TEST IN DIVISION OF DECIMALS

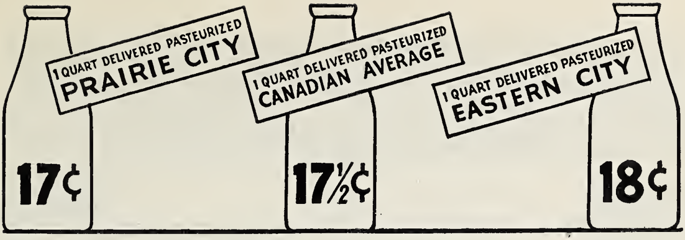
Copy each of the following examples and divide. If the exact value cannot be found, express the result to the nearest hundredth.

	a	*b*	*c*		*a*	*b*	*c*
I. (307)	$3\overline{)9.6}$	$24\overline{).72}$	$6\overline{)2.88}$	**II.** (307)	$2\overline{).5}$	$4\overline{).5}$	$3\overline{).168}$
III. (308)	$.4\overline{)9.2}$	$.7\overline{).154}$	$.4\overline{).136}$	**IV.** (308)	$.5\overline{).46}$	$.8\overline{)9.8}$	$1.6\overline{).72}$
V. (308)	$.02\overline{)1.2}$	$.03\overline{)5.1}$	$.16\overline{)12.8}$	**VI.** (308)	$4\overline{)3}$	$5\overline{)4}$	$8\overline{)5}$
VII. (308)	$3\overline{)7}$	$6\overline{)1}$	$9\overline{)7}$	**VIII.** (308)	$.12\overline{)9}$	$.08\overline{)1}$	$.16\overline{)3}$

IX. (308) Copy the following examples and place the point in the correct position in the quotients:

a. $\begin{array}{r}125\\25\overline{)312.5}\end{array}$	*b.* $\begin{array}{r}125\\25\overline{)3.125}\end{array}$	*c.* $\begin{array}{r}125\\25\overline{).3125}\end{array}$
d. $\begin{array}{r}125\\2.5\overline{)3125}\end{array}$	*e.* $\begin{array}{r}125\\.25\overline{)3125}\end{array}$	*f.* $\begin{array}{r}125\\2.5\overline{)31.25}\end{array}$
g. $\begin{array}{r}125\\2.5\overline{).3125}\end{array}$	*h.* $\begin{array}{r}125\\.25\overline{).3125}\end{array}$	*i.* $\begin{array}{r}125\\2.5\overline{)312.5}\end{array}$

If you made more than one error in any of the nine groups of examples, turn to pages 307–308 for practice exercises keyed to the test.



HOW MUCH FOR A QUART OF MILK?

The milk bottles show how the price of a quart of milk may vary in different cities.

1. What was the average cost of a quart of delivered pasteurized milk in Canada when the graph was made? At that rate, what was the cost of a gallon of milk?

2. What was the cost of a quart of delivered pasteurized milk in the Prairie City? In the Eastern City?

3. Using the prices shown, how many quarts of milk can be bought for one dollar in Prairie City? In Eastern?

4. Why does the cost of milk vary in different cities? The graphs (page 92) will help in answering this question.

5. What is pasteurized milk? What are its advantages?

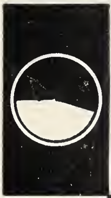
6. Compare the delivery cost of milk in your community with the rates given in the picture graph.

PLACING THE DECIMAL POINT

Copy each of the following examples and place the decimal point in the answer.

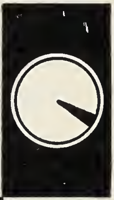
	a	*b*	*c*
1.	1.2 × 18 = 216	10 × 7.86 = 7860	.31 × .16 = 496
2.	.38 × 1.02 = 3876	.25 × 64 = 1600	.035 × 7.8 = 2730
3.	9.2 × .036 = 3312	.19 × .19 = 361	.01 × 0.1 = 1
4.	3.41 ÷ 11 = 31	100.8 ÷ 28 = 36	2.376 ÷ .72 = 33
5.	3.672 ÷ 68 = 54	6.474 ÷ 8.3 = 78	.5184 ÷ .54 = 96

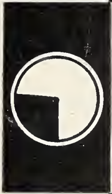
DISPOSITION OF OUR CONSUMER'S MILK DOLLAR



PAID TO FARMERS
54 $\frac{55}{100}$ cents

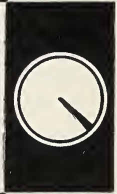
DELIVERY EXPENSES, FEED, TIRES, GASOLINE
6 $\frac{97}{100}$ cents

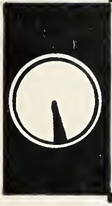




WAGES, SALARIES
25 $\frac{97}{100}$ cents

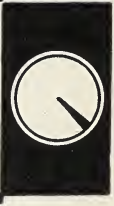
PLANT REPAIRS, DEPRECIATION
2 $\frac{01}{100}$ cents



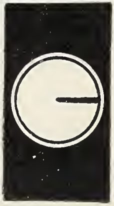


PASTEURIZING AND BOTTLING
6 $\frac{15}{100}$ cents

OFFICE EXPENSES, STATIONERY, HEAT, TELEPHONES, INSURANCE, LIGHT
2 $\frac{66}{100}$ cents



PROFIT
(before income tax)



THE CONSUMER'S MILK DOLLAR

Each dollar spent for milk might be called a **milk dollar.** The circle graphs (page 92) show how the average Canadian city dairy spends the consumer's milk dollar.

1. The cost of each item is expressed to the nearest hundredth of a cent. Read the amounts in the graph. Tell what each item means.

2. What item represents more than half the cost of milk to the consumer?

3. What is the sum of the items in the graph?

4. The difference between 100 cents and the total expenses (problem 3) is profit to the dairy for each dollar the consumer spends for milk, (before income tax is deducted). How much is this profit, (including tax)?

5. What would be the profit to the dairy for each $100 of milk sold to consumers?

6. What two items together represent about four-fifths of the cost of milk to the consumer?

7. These two items (problem 6) represent how much more than $.80?

8. This difference (problem 7) would amount to how much for each $100 worth of milk sold by the dairy?

9. For every $100 worth of milk sold by the dairy, how much of the cost goes to pay for pasteurizing and bottling? For office expenses?

10. How does the number of bottles broken or thrown away by the consumer affect the cost of milk?

11. *a.* A family uses three quarts of milk a day at 17¢ a quart. What is the yearly milk bill of the family (365 days)?

b. About how much of this money (problem *a*) gets back to the farmer who produced the milk?

c. About how much of it is paid to the people who work for the dairy?

MILK — SPECIAL AND STANDARD

20 cents ◂ PRICE PER QT. ▸ 18 cents
4 per cent ◂ BUTTERFAT ▸ 3.8 per cent

In most Canadian cities, two grades of milk are sold, special and standard. Both are pasteurized and healthful, but special milk comes from Jersey and Guernsey herds which give richer, creamier milk. The chart shows the difference.

1. What was the average cost of a quart of each grade of milk when the graph was made?

2. How much greater is the percentage of butterfat in special grade milk than in standard grade?

3. A "dairy bar" uses 40 quarts of milk a day. How much is its saving in a month of 30 days, by using "standard" instead of "special" milk? What percent is saved?

4. 1 qt. of standard milk weighs approximately 2.58 lb. How many pounds of butterfat may be obtained from 10 gal. of standard milk?

5. Milk from which the butterfat is taken, is called "skim milk". How many pounds of skim milk would remain, after removing the butterfat from 1 gal. of standard milk?

6. Do you think that more than one grade of milk should be sold? Give reasons.

★7. What is meant by inspection of cows? By monthly laboratory tests? Who makes these tests and inspections?

NOTE: Milk data approved by The National Dairy Council of Canada.

MORE FACTS ABOUT MILK

1. Milk is usually sold by dairy farmers in quantities of 100 pounds. There are 38.8 quarts of milk, on the average, in each 100 pounds. How many gallons are there in 100 pounds of milk?

2. To the nearest hundredth of a pound, find the weight of one quart of milk; of one gallon.

3. A dairy farmer has 32 cows, each of which produces 6000 pounds of milk a year. At 9.35 cents a quart, how much does the dairyman get for his milk?

4. A dairyman who had fine Holstein cows found that each cow produced, on the average 3510 quarts of milk a year. To get this yield, he fed each cow 2 tons of grain, 3 tons of hay, 5 tons of silage, put her in pasture 4 months of the year, and hired 200 hours of farm labour. If the grain cost $48 a ton, the hay $20 a ton, the silage $5 a ton, the pasture $4 a month, and the farm labour 40 cents an hour, what was the cost of producing the milk?

5. How much a quart would the dairyman's profit, (or loss) be, selling his milk at 9 cents a quart.

LET'S PRACTISE

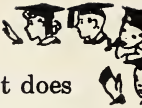
	a	*b*	*c*	*d*
1.	$1.2 \times 18 = ?$	$9.6 \div 6 = ?$	$4 \div 25 = ?$	$.9 \times .96 = ?$
2.	$.72 - .38 = ?$	$\$5 - \$1.96 = ?$	$7 \times 8.46 = ?$	$.5184 \div .54 = ?$
3.	$9 \div .01 = ?$	$6.4 \times 15.8 = ?$	$.736 - .729 = ?$	$.03 \times 4.7 = ?$

4. $.46 + .50 + .87 + .39 + .68 + .95 = ?$

5. Find the value of the following to the nearest hundredth:

a. $\frac{2}{3}$; *b.* $\frac{5}{8}$; *c.* $\frac{1}{6}$; *d.* $\frac{4}{7}$; *e.* $\frac{4}{9}$; *f.* $\frac{7}{9}$; *g.* $\frac{5}{16}$; *h.* $\frac{8}{11}$.

HOW WELL DO YOU REMEMBER?



1. Our number system is a decimal system. What does that mean?

2. Give the place value of each figure in 42.75.

3. How does our number system differ from the Roman system other than by the use of different symbols?

4. Round off the following to the nearest hundredth: *a.* .452; *b.* .3449; *c.* .995; *d.* 1.096.

5. Multiply the following by 100: *a.* 5.63; *b.* .0054; *c.* .0167; *d.* 34.5; *e.* 15.45; *f.* .078; *g.* .001.

6. Divide the following by 100: *a.* 87.5; *b.* 1.25; *c.* 789.5; *d.* .9; *e.* 1.5; *f.* 3; *g.* 3.14.

7. Copy the following sentence and insert the missing words: To multiply a decimal by 100, move the decimal point (?) places to the (?); to divide a decimal by 100, move the decimal point (?) places to the (?).

8. Find the position of the decimal point in the following:

a. $.17 \times 1.7 = 289$ *c.* $.12 \times .12 = 144$ *e.* $6 \times .09 = 54$
b. $.25 \times .1 = 25$ *d.* $.4 \times .08 = 32$ *f.* $.16 \times 9 = 144$

9. Where is the decimal point placed in the sum? in the remainder?

10. How may a divisor in the form of a decimal be changed to a whole number?

11. State what is the smallest number each of the following must be multiplied by to make it a whole number:

a. .4; *b.* .37; *c.* 1.65; *d.* .125; *e.* 45.2.

12. Arrange the following decimals in order of size, beginning with the smallest: *a.* .6; *b.* .48; *c.* .125; *d.* .25; *e.* 1.5.

13. Find the decimal value of the following fractions:

a. $\frac{1}{2}$; *b.* $\frac{3}{4}$; *c.* $\frac{5}{8}$; *d.* $\frac{4}{5}$; *e.* $\frac{3}{8}$; *f.* $\frac{9}{16}$; *g.* $\frac{3}{25}$; *h.* $\frac{7}{20}$.

14. Find the decimal value of the following fractions to the nearest hundredth: *a.* $\frac{1}{3}$; *b.* $\frac{5}{6}$; *c.* $\frac{7}{8}$; *d.* $\frac{4}{9}$; *e.* $\frac{2}{3}$; *f.* $\frac{7}{16}$.

15. Copy and complete each of the following examples. Express each answer as a decimal:

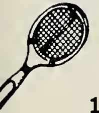
a. 8 hr. 45 min. = ? hr.
b. 7 ft. 3 in. = ? ft.
c. 4 gal. 3 qt. = ? gal.
d. 5 bu. 1 pk. = ? bu.

16. The first-class passenger rate by rail between Saskatoon and Winnipeg is 3.45 cents a mile; by coach, 3 cents a mile. If the distance is 470.4 miles, find the difference in cost between the two rates of fare for the trip.

17. A family pays 17 cents for a quart of milk. If the family uses 2 quarts each day, what will be its milk bill for a year of 365 days?

18. The average daily use of milk for each person in Canada is about .97 pints. At that rate, what is the number of quarts of milk used by each Canadian resident each week? Each year of 52 weeks?

19. A kilometre is 1000 metres. If a metre is equal to 39.37 inches, how many inches are there in a kilometre?



LET'S PRACTISE WITH DECIMALS

	a	*b*	*c*
1.	\$7 − \$1.65 = ?	1.035 − 0.956 = ?	6.0 − 0.6 = ?
2.	6.4 × 15.8 = ?	.08 × .97 = ?	.03 × .01 = ?
3.	.806 ÷ 2.6 = ?	19.8 ÷ 60 = ?	6 ÷ .01 = ?

4. .523 + .048 + .936 + .415 + .726 + .005 = ?

5. Copy the result in each of the following examples and insert the decimal point in correct position:

a. .38 × 1.02 = 3876
b. 5.4 × .096 = 5184
c. 16.848 ÷ 5.2 = 324
d. .035 × 7.8 = 2730
e. 729 ÷ .09 = 81
f. .0036 ÷ .02 = 18

THINGS TO REMEMBER

1. *What is meant by the decimal system of number.*
2. *How to add, subtract, multiply, and divide decimal fractions.*
3. *How to express common fractions as decimals.*
4. *How to round off a decimal to a given degree of accuracy.*

TEST ON CHAPTER III

1. Why is it not necessary to have zero in a number system if an abacus is used?

2. Copy the following sentence and insert the missing words: One place to the right of the decimal point represents (?); two places represent (?); three places represent (?); and four places represent (?).

3. Round off the following decimals to the nearest tenth:

a. 7.43; *b.* 0.55; *c.* .96; *d.* .449; *e.* 1.092.

4. Change the following to decimals:

a. $\frac{3}{8}$; *b.* $\frac{4}{8}$; *c.* $\frac{9}{16}$; *d.* $\frac{11}{20}$; *e.* $\frac{4}{5}$; *f.* $\frac{7}{25}$.

5. Do you think it is more difficult to compute with decimals or with common fractions? Why?

6. Which is longer, a board 7 feet 6 inches or one 7.4 feet? How much longer?

7. A piston ring in an automobile engine is five ten-thousandths oversize. Write this amount in decimal form.

8. Which is greater, .1 or .01? How many times greater?

9. Select the approximate answer to the following: A certain grade of bricks cost $29.50 for 1000. At that rate, one brick costs about: *a.* .3¢; *b.* 3¢; *c.* 30¢; *d.* $3.

10. Express 3 hr. 36 min. as hours.

11. Arrange the following decimals in order of size, beginning with the smallest: *a.* .5; *b.* 1.2; *c.* .05; *d.* .55; *e.* 5.5.

⋆TOPICS FOR SPECIAL REPORTS

1. In the metric system of measure, decimals are used in place of common fractions for expressing part of a given unit. Tell why.

2. Why is it not possible to have decimal fractions in the Roman system of number?

3. Some people have urged the adoption of a ruler on which the foot is **decimalized.** What does this mean? How would such a ruler differ from the ruler used in the metric system?

4. Find the batting averages of the four leading hitters last season in each of the two major leagues.

5. What was the best earned run average of the leading pitcher in each major league of baseball during the past year?

6. Find the yearly production of milk by the world's champion cow.

LET'S PRACTISE

8

1. 7.96
0.88
6.59
3.05
8.27
3.43

2 73256
−19087

3. $4\frac{5}{8}$
$-1\frac{3}{4}$

4. $6\frac{1}{2} \div 5 = ?$

5. $9 \div 2\frac{2}{3} = ?$

6. $7\frac{1}{3}$
$2\frac{5}{6}$
$8\frac{1}{4}$
$3\frac{1}{2}$

7. $7\frac{1}{2} \times 2\frac{1}{3} = ?$

8. $94 \times 3.65 = ?$

9. $15 \div .3 = ?$

10. $14.4 \div .12 = ?$

11. $.03 \times .87 = ?$

12. $7.36 \times 902 = ?$

13. $4.8 + 9.9 + 3.6 = ?$

14. $70.4 - 29.564 = ?$

15. $\frac{6}{7} \div 5\frac{1}{7} = ?$

16. Find the value of $\frac{7}{9}$ to the nearest hundredth.

PROGRESS TEST

This test contains the important kinds of examples you have studied.

1. Find the sum of $9\frac{3}{4} + 5\frac{7}{8} + 6\frac{1}{2}$. (43)
2. Subtract $7\frac{2}{3}$ from $16\frac{3}{8}$. (46)
3. How much is $5\frac{1}{3} \times 2\frac{1}{4}$? (48)
4. Divide $7\frac{1}{2}$ by 3. Check by multiplication. (54)
5. Divide $3\frac{1}{3}$ by $13\frac{1}{3}$. Check by multiplication. (54)
6. Find the sum of 96.48 + 8.75 + .04 + 16.80. (66)
7. Subtract 27.85 from 96.42. (67)
8. Multiply 27.5 by 9. Check by division. (70)
9. Multiply 18.4 by 2.6. Check by division. (70)
10. How much is 10 × 3.7? 100 × .265? (75)
11. Reduce to decimals: $\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{8}$. (76)
12. Express as decimals to the nearest hundredth: $\frac{2}{3}$, $\frac{5}{6}$, $\frac{3}{7}$. (78)
13. Express as feet and decimal of a foot: 5 ft. 3 in. (88)
14. Divide 3.87 by 9. Check by multiplication. (86)
15. Round off to the nearest tenth: 3.562; 4.826. (77)
16. Divide 22.365 by 1.5. Check by multiplication. (86)
17. Divide 16 by .25. Check by multiplication. (86)
18. Divide 95.8 by 74.8. Express the quotient to the nearest hundredth. (86)
19. How much is 27.6 divided by 10? by 100? (75)
20. Arrange the following decimals in order of size from the smallest to the largest: .5, .1, .125, .05, .15, 1.1, .01. (68)

If you had difficulty on any of these examples, turn to the key pages in parentheses. Do not be satisfied until you can work every example in the test correctly.

TO A NEW CHAPTER

WORKING TOGETHER

CONSUMERS' CO-OP. MILLS

In every province in Canada co-operative business organizations have been formed. The two main kinds of co-operatives are **producer co-operatives** and **consumer co-operatives.** The purpose of these co-operatives is to provide their members with services at cost.

For example, a group of farmers may organize to market their grain. They decide to distribute the surpluses, if any, among themselves in proportion to the amount of grain each has delivered. Similarly, a group of consumers may organize to purchase their requirements at cost, and likewise any surpluses are distributed to the members in proportion to their purchases. The surpluses, if any, distributed in this manner are known as **"patronage dividends."**

1. The most important products marketed in Western Canada by co-operatives is grain. In a recent year the 1210 co-operative elevators handled 155,600,000 bushels of grain. What was the average number of bushels handled by each elevator?

2. The Eastend Sheep and Livestock Co-operative, composed of 29 members, showed a surplus of $4,099.73 for a recent year. What would be the average dividend paid to each member?

3. A certain member of the Eastend Co-operative delivered livestock worth $450 to the co-operative. If

the total sales of the co-operative were $15,000, how much of the net surplus shown in problem 3 would this member receive?

4. In a town co-operative with a membership of 350, the sales for last year totalled $117,427.42. This was made up of sales of petroleum products amounting to $55,816.45; coal and wood, $10,007.31; and the remainder in groceries.

(a) What was the total value of the groceries sold?
(b) What was the average value of all goods purchased by each member?
(c) If the net surplus for the year was $9,986.57, what was the average dividend per member?

5. A group of farmers was encouraged by their co-operative to use commercial fertilizers on their land. One farmer using fertilizer on a 75-acre field increased his yield from 14.4 bushels an acre to 18.5 bushels an acre. What was the increase in yield an acre? What was the gain on the whole field?

6. Some manufacturing plants such as flour mills and oil refineries operate as co-operatives. A co-operative mill gives in exchange for 60 pounds of No. 1 wheat, 37.5 lb. of flour, 17.2 lb. of bran, and 5.3 lb. of shorts. How many pounds of each of the above products will a farmer receive for 78 bu. of No. 1 wheat?

7. In a recent year a co-operative oil refinery processed 438,000 barrels of oil and distributed it to 250 local oil co-operatives. What was the average number of barrels distributed to each local co-operative?

8. A co-operative oil refinery starting in 1934 with an investment of $32,000, is now valued at $1,000,000. How much has the value of the refinery increased?

CO-OPERATIVES IN CANADA

Province	Number of Members	Total Volume of Business
Prince Edward Island	12,327	$ 4,221,860
Nova Scotia	16,242	11,577,710
New Brunswick	8,043	6,507,790
Quebec	61,713	62,275,269
Ontario	57,715	77,507,707
Manitoba	116,043	47,927,942
Saskatchewan	237,842	191,164,395
Alberta	149,196	99,080,370
British Columbia	28,675	35,626,053
Interprovincial	52,008	47,426,851

This table shows the membership in all co-operatives and the total volume of business done by them according to provinces, during a recent year.

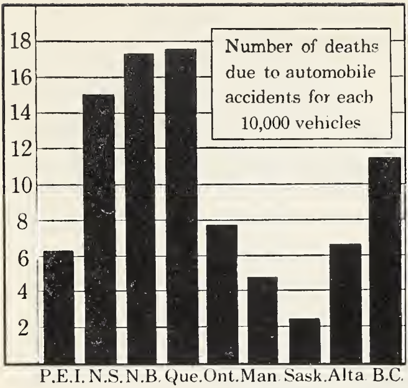
1. What was the total volume of business carried on by co-operatives in Canada?

2. What was the total membership in Canada?

3. What was the average volume of business done by each member in Manitoba? in Alberta? in British Columbia? in Saskatchewan?

4. During 1946 co-operatives in Canada purchased supplies and merchandise valued at $81,360,855. In 1945 the purchases amounted to $65,875,368. What was the amount of increase?

*5. Another form of co-operative enterprise is the **Credit Union.** Is there a Credit Union in your locality? If so, find out how it operates and report to your class.



DRIVE SAFELY

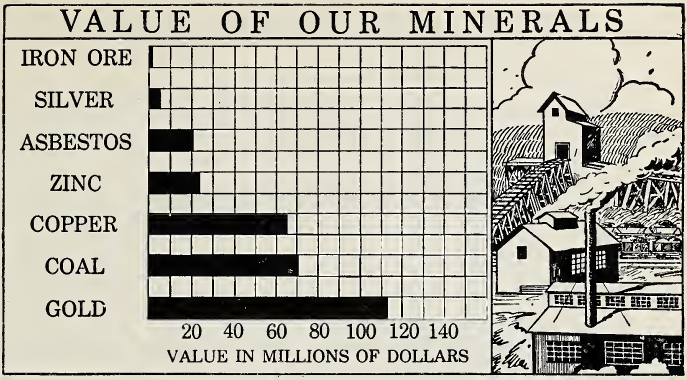
This bar graph shows the number of deaths resulting from automobile accidents for each 10,000 motor vehicles operated during a certain year. A **vertical** (extending upwards) **bar** represents the number of deaths in each province. The graph, therefore, is called a **vertical bar graph.**

1. In which province was the rate of fatal (causing death) accidents lowest? highest? About how many fatalities occurred for every 10,000 vehicles operated in each of these 2 provinces?

2. In which provinces were there about 17 deaths for each 10,000 vehicles? about 6 deaths? about 3?

3. Why is the number of fatal automobile accidents not the same for each province? Name at least three things which affect the number of automobile fatalities.

*4. What steps have been taken by your local traffic bureau to reduce the number of motor car accidents in your community?



THE VALUE OF OUR MINERALS

This bar graph shows the average yearly value of certain minerals produced in Canada. It is a **horizontal bar graph,** so called because bars extend across the page in the same direction as a line of print. The numbers at the bottom of the graph are to be read in millions of dollars.

1. About what is the value of the gold mined each year in this country? the copper? the iron ore?

2. From the graph, which of the minerals has a value of about $21,000,000?

3. If the price of gold is $35 an ounce, about how many ounces of gold are mined each year in this country?

4. How many dollars are represented by each square along the horizontal scale?

5. How much more or less is the value of gold mined than the value of all other minerals?

★6. If each square along the horizontal represented $20,000,000, how would that affect the length of each bar? $5,000,000?

HOW TO CONSTRUCT BAR GRAPHS

In constructing a bar graph:

1. **Decide whether the bars shall be vertical or horizontal.** In which direction did the bars extend in the graph (page 105)?

2. **Select the largest number to be graphed.** What was the largest number represented on the graph (p. 105)?

3. Use **graph paper or paper cross ruled** so as to form squares. Cross rule a small sheet of paper into half-inch squares.

4. **Decide about how many squares shall be used to represent the largest number.** About how many squares represented the largest number in the graph (p. 105)?

5. To find the approximate scale of the graph, **divide the largest number to be graphed by the number of squares used to represent that number.**

   a. What was the scale of the graph (p. 105)?

   b. If the largest amount to be shown had been $1,000,000, what scale could have been used?

6. **Round off large numbers.** Were the numbers rounded off in the graph? How do you know?

7. **Divide each amount by the scale value** to find the number of squares to represent each bar. The value of coal produced in Canada, according to the graph (page 105), is about $70,400,000. How many squares are used to represent this amount?

8. **Draw all bars the same width with equal spaces between.** Was this plan followed in the construction of the graph?

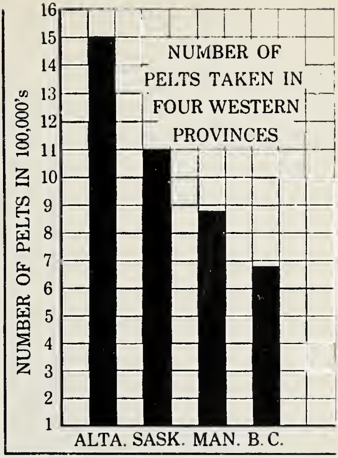
9. A graph is usually more accurate if the scale begins at zero. Where does the scale for the graph begin?

10. **Label the graph.** What is the title of the graph?

STEPS IN MAKING BAR GRAPHS

The rules for constructing bar graphs (page 106) are applied in graphing the following data.

Show by a bar graph the number of pelts taken in Canada's four western provinces in a recent year: Alberta, 1,514,000; Saskatchewan, 1,100,000; Manitoba, 881,000; British Columbia, 682,000.



The number given to each of the following items refers to a rule on page 106.

1. Bars are drawn vertically to show number of pelts.
2. What is the largest number to be graphed?
3. Cross-ruled paper is used.
4. The longest bar should contain about 15 squares.
5. When the largest number is divided by 15, the quotient is about 100,000, so the scale used is 100,000.
6. The number of pelts taken in Alberta, to the nearest 100,000, is 1,500,000. Round off the other numbers to the nearest 100,000.
7. The number of squares in each bar is found by dividing the different numbers by 100,000. How many squares should be in each bar?
8. Are all bars constructed to the same width? Is the width of spaces between consecutive bars the same?
9. Does the scale begin at zero?
10. What is the legend or caption of the graph?

CONSTRUCTING BAR GRAPHS

Construct bar graphs from the following data:

1. The amount of milk used in one year by each person in different countries was as follows: Switzerland, 232 qt.; Canada 160 qt.; United States, 152 qt.; Denmark, 144 qt.; Great Britain, 92 qt.; France, 92 qt.; Italy, 28 qt.

2. The number of Vitamin A units in each ounce of certain foods is as follows: butter, 950 units; milk, 65 units; eggs, 940 units; carrots, 1300 units; spinach, 1500 units; tomatoes, 170 units.

3. Various time records for one mile were: airplane, $6\frac{1}{5}$ sec.; automobile, 10 sec.; train, 30 sec.; horse, 94 sec.

4. The average number of miles walked daily by people in different occupations is as follows: boy, age 10–16 years, 15 miles; letter carrier, 22 miles; farmer cultivating soil, 25 miles; housewife, 8 miles.

***5.** The population of Manitoba at intervals of 10 years since 1891 was:

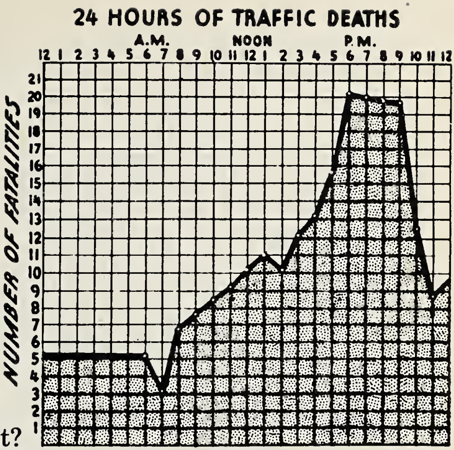
1891	152,000	1921	610,000
1901	255,000	1931	700,000
1911	460,000	1941	730,000

***6.** Find the number of square miles in each of the four western provinces and show these amounts by bar graphs.

***7.** Find the length of the four longest rivers in the world and show their lengths by bar graphs.

***8.** Find the height of the four highest mountain peaks in North America and show their heights by bar graphs.

MORE ACCIDENTS IN THE EVENING



This **line graph** shows the total number of deaths in one city resulting from automobile accidents at each hour of the day during a period of 17 months.

1. During which hour of the day was the number of fatalities the greatest? the least?

2. About how many were killed during the hour when the greatest number of fatalities occurred? the least?

3. Were there more or fewer fatal traffic accidents in the morning than in the afternoon?

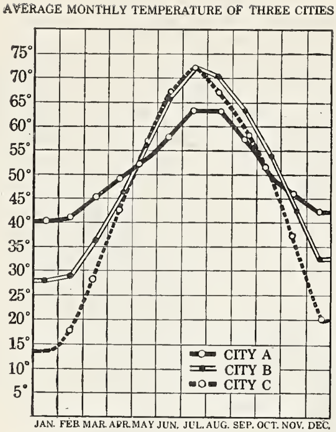
4. During which hours were there about five deaths each, due to automobile accidents?

★5. Why does the number of fatalities from automobile accidents vary with the time of day?

LET'S PRACTISE

⑨

	a	*b*	*c*
1.	$3710 - 924 = ?$	$8000 - 1007 = ?$	$5\frac{1}{4} - 4\frac{5}{6} = ?$
2.	$76 \times 94 = ?$	$.03 \times 4.89 = ?$	$1.05 \times 4.55 = ?$
3.	$2112 \div 9 = ?$	$1728 \div 36 = ?$	$18546 \div 265 = ?$
4.	$4\frac{4}{5} \times \frac{3}{8} = ?$	$\frac{3}{4} \times 76 = ?$	$1\frac{1}{2} \div 3 = ?$
5.	$497 + 809 + 168 + 573 + 964 + 375 = ?$		
6.	Add: *a.* 8 ft. 7 in. and 5 ft. 9 in. *b.* 3 gal. 2 qt. and 4 gal. 3 qt.		



WHAT DOES THE THERMOMETER SAY?

1. In which city is there the greatest change in temperature during the year? the least change?

2. About what is the average temperature in City B in February? in April? in July? in September? in November?

3. About what is the average temperature in City C and in City A for the months given in problem 2?

4. During which three months are the average temperatures of the cities about the same?

5. Which is the coldest month of the year in City A? City B? City C? the warmest month?

6. Which city shows the greatest difference between summer and winter temperatures? the least?

MAGIC SQUARES

Copy the squares and insert the missing numbers.

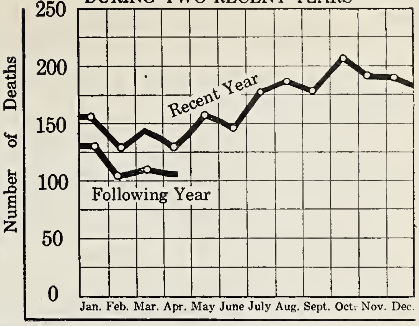
19	?	13	28
?	27	20	15
26	11	18	?
?	22	25	?

$1\frac{1}{3}$	$\frac{1}{6}$	?	$1\frac{1}{12}$
?	$\frac{11}{12}$	$\frac{5}{6}$	$\frac{2}{3}$
$\frac{3}{4}$	$\frac{7}{12}$	$\frac{1}{2}$	?
?	$1\frac{1}{6}$	$1\frac{1}{4}$	?

5.75	2.25	2.50	?
?	4.50	4.25	3.75
?	?	3.25	4.75
2.75	5.25	5.50	2.00

CONSTRUCTING LINE GRAPHS

MOTOR VEHICLE FATALITIES IN CANADA DURING TWO RECENT YEARS



The upper line in the graph shows the number of deaths from automobile accidents each month during one year. The lower line (incomplete) shows the number of deaths from automobile accidents during the first 4 months of the following year.

1. The number of fatalities for each of the eight months not graphed is as follows: May, 120; June, 115; July, 130; August, 140; September, 145; October, 155; November, 150; December, 145. Using these numbers, copy and complete the graph.

2. Using these data, construct a line graph to show the number of lives lost in automobile accidents.

1936	1300	1939	1600
1937	1650	1940	1700
1938	1500	1941	1850
1942	1400		

***3.** Find the average monthly temperature of your community, or of the largest city in your province and make a line graph to show this temperature.

LET'S PRACTISE

⑩

	a	*b*	*c*
1.	$7 \times 908 = ?$	$.6 \times .732 = ?$	$25 \div .04 = ?$
2.	$24 \div 1\frac{1}{2} = ?$	$4\frac{1}{2} \times 6\frac{2}{3} = ?$	$30 \times \frac{3}{8} = ?$
3.	$7 \times 3\frac{11}{12} = ?$	$8.65 \div 100 = ?$	$\frac{5}{6} \times \frac{18}{25} = ?$
4.	$1 \div \frac{5}{9} = ?$	$4\frac{1}{2} \div 2\frac{1}{4} = ?$	$3420 \div 17 = ?$

5. To the nearest hundredth, find the value of:

a. $\frac{1}{3}$; *b.* $\frac{5}{6}$; *c.* $\frac{7}{8}$; *d.* $\frac{4}{9}$; *e.* $\frac{5}{12}$.

PROBLEMS WITHOUT NUMBERS

In each problem tell whether you would add, subtract, multiply, or divide.

1. If you know how much money you had before you made some purchases and the amount you had left, how do you find the cost of the things which you purchased?

2. If you know the cost of a dozen golf balls, how do you find the cost of one ball?

3. If you know the number of gallons of gasoline used and the average number of miles to a gallon, how do you find the distance travelled?

4. If you know the speed of light and the distance from the earth to a star, how do you find the time it will take light to travel from a star to the earth?

5. If you know the length of a fence on one side of a square garden, how do you find the length of fence needed to enclose the garden?

6. If the weight of each member of a football team is known, how do you find the average weight of each player?

*TOPICS FOR SPECIAL REPORTS

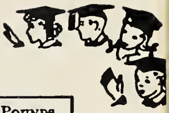
1. Make a list of at least five different co-operative organizations in your province.

2. Bring to class different kinds of graphs which you find in newspapers and books. Decide if the graphs are well constructed.

3. Finding the location of a place on a map by use of map finders makes use of the same principle as finding the position of a point in a line graph. Show that this is true.

4. A line graph is a graph of two variables. What does this mean?

HOW WELL DO YOU REMEMBER?



Babies increase in weight very rapidly. The table at the right shows the average weight of infant boys and girls at different times during the first two years.

Age	Weight in Pounds	
	Boys	Girls
At birth	7.6	7.16
3 months	13.0	12.5
6 months	18.0	16.8
9 months	20.4	19.2
12 months	21.9	20.8
15 months	23.6	21.8
18 months	24.6	23.4

1. Draw a line graph showing how boys increase in weight during the first 18 months.

2. Draw a similar graph for girls.

3. Find the average monthly increase in weight for boys and girls between birth and 3 months; between 15 months and 18 months.

4. When does the greatest increase in weight occur?

5. Here is the record of the weights of Harold and Helen for a period of five years. Make graphs showing their weights each year.

Age	Harold	Helen
7	50 lb.	45 lb.
8	55 lb.	52 lb.
9	61 lb.	59 lb.
10	67 lb.	66 lb.
11	73 lb.	75 lb.

6. Should a bar graph or a line graph be used to show hourly temperatures of a place? Why?

7. Measure your height and weight on the first day of each month for a number of months. Make graphs of your height and weight to see how much you are growing.

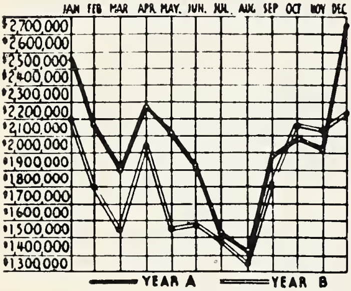
THINGS TO REMEMBER

1. *How to read and interpret picture graphs.*
2. *How to read and construct bar graphs and line graphs.*

TEST ON CHAPTER IV

1. To the nearest mile, the lengths of certain ship canals are: Cape Cod, 13 mi.; Kiel, 61 mi.; Suez, 105 mi.; Panama, 51 mi. Show these lengths by a bar graph.

2. The graph shows the earnings for two years of a gas and electric service company.



a. In which year were the earnings the higher?

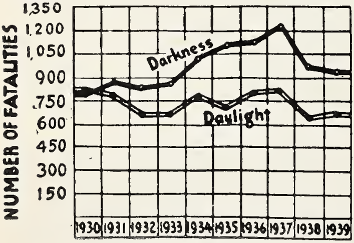
b. During which two months were the company's earnings the highest? the lowest?

c. In which month of Year B were the earnings about $2,000,000?

d. Does the graph begin at zero? Why or why not?

3. The graph shows automobile fatalities in this country during daylight and darkness for the period, 1930–1939.

a. In how many years was the number of fatalities greater during darkness than during daylight?



b. About how many fatalities during darkness occurred in 1932? in 1935?

c. About how many fatalities occurred in the daytime in 1930? in 1939?

d. In which year was the difference between the two groups the greatest? the least?

PROGRESS TEST

If you have difficulty with any part of this test, turn to the key page where the process is explained.

1. $7.46 + 0.38 + 5.98 + 1.50 + 17.45 = ?$ (66)

2. How much greater is 4752 than 1785? (11)

3. Divide 9125 by 16. Check the result by multiplication. (22)

4. $7\frac{3}{8} + 9\frac{1}{4} + 8\frac{1}{2} + 5\frac{7}{8} + 1\frac{3}{4} = ?$ (43)

5. Find the difference between $11\frac{1}{2}$ and $5\frac{2}{3}$. (46)

6. What place to the right of the decimal point represents hundredths? ten thousandths? (65)

7. Add 7 gal. 3 qt. and 4 gal. 2 qt. (9)

8. Subtract 12 ft. 6 in. from 15 ft. 9 in. (11)

9. Multiply 3.65 by .78. (70)

10. Find the product of 308 and 480. (15)

11. Write 1026 with Roman numerals. (64)

12. Express as decimals: *a.* $\frac{3}{4}$; *b.* $\frac{1}{8}$; *c.* $\frac{1}{4}$. (76)

13. Find the decimal value of $\frac{2}{3}$ to the nearest hundredth. (78)

14. Arrange in order of size: $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{1}{3}$, $\frac{2}{3}$. (68)

15. Arrange in order of size: .4, 1.2, .75, .04, .5. (68)

16. What must be added to $3\frac{1}{2}$ to equal $8\frac{1}{4}$? (46)

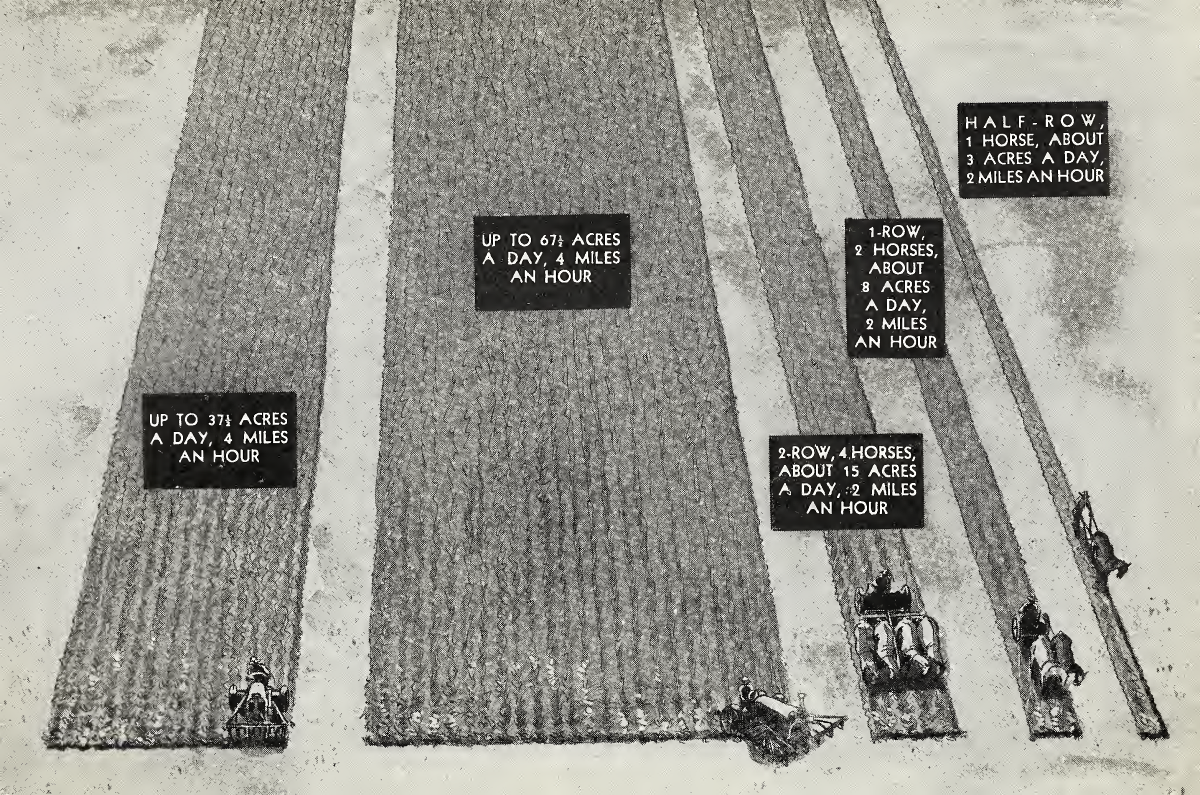
17. How often will 9 contain $2\frac{1}{4}$? (54)

18. How many pieces $\frac{3}{4}$ yard long can be cut from a piece of ribbon 24 yards long? (54)

19. Find the cost of $2\frac{3}{4}$ pounds of steak at 36¢ a pound. (48)

20. Express 3 hr. 45 min. as hours and a decimal part of an hour. (88)

TO A NEW CHAPTER


HALF-ROW, 1 HORSE, ABOUT 3 ACRES A DAY, 2 MILES AN HOUR
1-ROW, 2 HORSES, ABOUT 8 ACRES A DAY, 2 MILES AN HOUR
2-ROW, 4 HORSES, ABOUT 15 ACRES A DAY, 2 MILES AN HOUR
UP TO 67½ ACRES A DAY, 4 MILES AN HOUR
UP TO 37½ ACRES A DAY, 4 MILES AN HOUR

CHAPTER V

THE MOTORIZED FARM

Tractors, driven by engines which burn fuel oil or gasoline, can do more farm work in less time than can horse-drawn machinery. Page 116 shows this quite well.

1. The speed of a motor-driven farm cultivator is how many times the speed of a horse-drawn cultivator?

2. If the number of horses to a machine is doubled, will they cultivate double the number of acres a day? more? or less?

3. The number of acres that can be cultivated with a large tractor is how many times as much as can be cultivated with one horse? with a team of 2 horses? 4 horses?

4. The number of acres that can be cultivated with the larger tractor is how many times as much as with the smaller tractor?

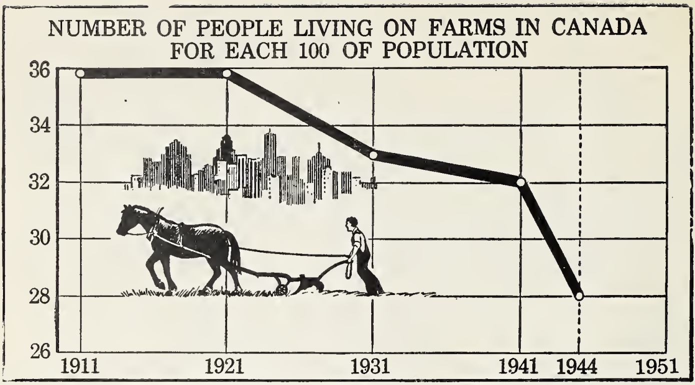
5. The number of acres that can be cultivated with the smaller tractor is what part of the number of acres that can be cultivated with the larger tractor? ($37\frac{1}{2} \div 67\frac{1}{2} = ?$)

6. If a farmer had 160 acres to cultivate, how many hours must he work with the

a. one-horse cultivator?
b. two-horse cultivator?
c. four-horse cultivator?
d. larger tractor?
e. smaller tractor?

*7. In 1800 the labour of **one** farmer produced food enough for 6 persons; to-day, 18 persons. What brought about this change?

*8. How has the use of power-driven farm machinery affected the number of farm labourers needed? How has it affected unemployment?



FEWER FARMERS

Martha read the following headline in her daily paper, **"Fewer People on Farms."** Accompanying the news item was a chart showing the number of farm people to each 100 of our population.

1. About how many people in each 100 of our population lived on farms in 1911? in 1921? in 1931? in 1941? in 1944?

2. In 1911 slightly more than 1 person in every 3 lived on farms. During what 10-year period did this ratio remain the same?

3. If Canada's population in 1941 was 11,506,000, how many persons lived on farms in that year?

4. Has the trend of the graph been downward or upward since 1911? Can you suggest any reason for the marked drop in farm population between 1941 and 1944?

*5. What are some of the things which cause people to leave their farm homes for other work?

READINESS TEST IN PERCENTAGE

I. How many hundredths are in each of these numbers?

a. .25 *b.* .08 *c.* $.12\frac{1}{2}$ *d.* .045 *e.* .2 *f.* .3 *g.* 1.00 Oral

II. Change the denominators of these fractions to hundredths. Express the answers as fractions, then as decimals:

a. $\frac{1}{2}$ *b.* $\frac{3}{4}$ *c.* $\frac{2}{5}$ *d.* $\frac{7}{25}$ *e.* $\frac{9}{20}$ *f.* $\frac{3}{10}$ Brd

III. Express the following decimals as common fractions:

a. .25 *b.* .75 *c.* .20 *d.* .5 *e.* $.33\frac{1}{3}$ *f.* $.66\frac{2}{3}$ Brd

IV. Change the following fractions to decimals, correct to the nearest hundredth: *a.* $\frac{1}{3}$ *b.* $\frac{5}{6}$ *c.* $\frac{7}{9}$ Bd

V. Multiply. Watch the decimal points:

1.	2.	3.	4.	5.	6.
\$27.50	96	83.5	60	\$12.75	395
×.06	×.25	×.40	$\times .33\frac{1}{3}$	×.28	×1.07

Bd

VI. Divide. Carry the work to two decimal places. Express the remainder in the quotient as a fraction.

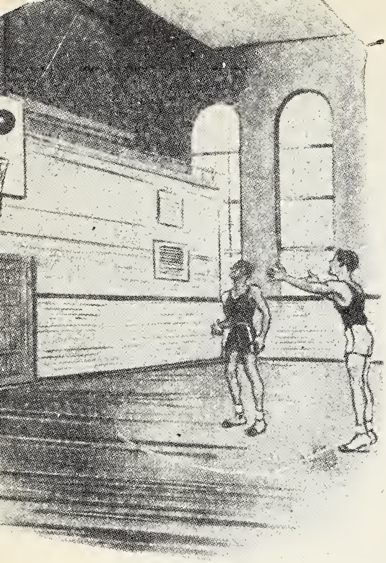
	a	*b*	*c*	*d*	*e*
1.	$20\overline{)15}$	$36\overline{)9}$	$\$1.80\overline{)\$.60}$	$480\overline{)300}$	$600\overline{)500}$
2.	$20\overline{)1}$	$25\overline{)3}$	$98\overline{)16.7}$	$45\overline{)93.6}$	$85\overline{)36.75}$

VII. Add or subtract as the sign indicates:

1.	2.	3.	4.	5.	6.
33.7	86.75	4.85	96	100	100
+52.5	−3.98	+3.75	−27.3	−95.4	+3.7

VIII. Parts and wholes.

1. How much less than a whole circle is .25 circle? .5 circle?
2. How many hundredths are in 1? how many tenths?
3. Show that .4 equals .40.
4. Show that 1.2 equals 120 hundredths.



THE FREE THROW IN BASKETBALL

Tom and Dick were practising "free throws" on a basketball court. Tom shot 13 goals out of 20 trials. Dick shot 17 goals out of 25 trials. Which boy is the better "shot"?

Tom's ratio of successful shots may be shown by the fraction $\frac{13}{20}$. Why? Dick's, by the fraction $\frac{17}{25}$. Why?

In order to compare these two fractions, they must be changed to fractions having the same denominator. The smallest common denominator of 20 and 25 is 100.

$$\frac{13}{20} = \frac{5 \times 13}{5 \times 20} = \frac{65}{100} \qquad \frac{17}{25} = \frac{4 \times 17}{4 \times 25} = \frac{68}{100}$$

Dick's record is the better. He was successful on .68 of his trials; Tom was successful in only .65 of his trials. We say that Dick succeeded in 68 **per cent** of his trials, while Tom succeeded in only 65 **per cent** of his trials.

Per cent is another name for hundredths.

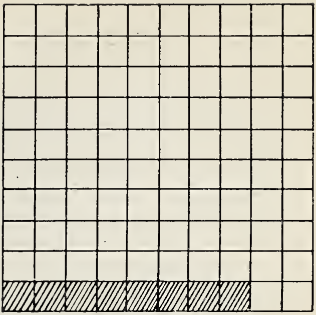
68 per cent may be written: 68%. It is read, "68 per cent." It means 68 hundredths, or .68. Also, 65 per cent may be written: 65%. How is it read? What does it mean?

1. Express each of the following per cents as a decimal: *a.* 85%; *b.* 96%; *c.* 75%; *d.* 60%; *e.* 5%.

2. Tell what each per cent in problem **1** means.

3. Write the following as per cents: *a.* $\frac{77}{100}$; *b.* $\frac{50}{100}$; *c.* $\frac{84}{100}$; *d.* .95; *e.* .04; *f.* .20; *g.* .24; *h.* .01; *i.* .10.

SHOWING PER CENT BY A GRAPH



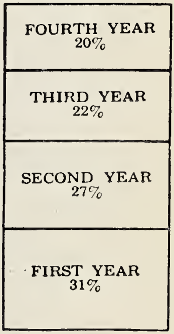
On a rainy day, 8 per cent of the pupils enrolled in the King George School were absent. This is shown by the graph.

1. As graph paper is being used to represent per cent, 100 squares are shown. Why?

2. How many squares are shaded to represent 8%?

3. How many squares should be shaded to represent 10%? 1%? 25%?

4. On graph paper, or cross-ruled paper, represent the following: 5%; 33%; 75%; 50%.



5. What part of the total number of squares is used to show 50%?

6. What fraction is equal to 50%?

7. In the Victoria High School, the enrolment was distributed among the four classes as shown. What per cent of the student body was in each class? What is the sum of the per cents?

The total enrolment (problem 7) is equal to what per cent of the student body?

The whole of a thing is equal to 100% of it.

LET'S PRACTISE

⑪

	a	*b*	*c*
1.	$9\frac{1}{4} - 4\frac{7}{8} = ?$	$3000 - 1037 = ?$	$.945 - .496 = ?$
2.	$.38 \times 76.4 = ?$	$1\frac{7}{8} \div 5 = ?$	$5\frac{2}{3} - 4\frac{5}{6} = ?$
3.	$4\frac{3}{8} \times 36 = ?$	$27 \div \frac{6}{7} = ?$	$256\overline{)18375}$

4. Find the sum of 9 ft. 8 in. and 4 ft. 10 in.

QUALITIES A CAR SHOULD HAVE

A manufacturer of automobiles made the following list of desirable qualities which a car should have. Then he asked buyers to vote for those qualities they considered "most desirable." The numbers listed show the percentage of buyers who voted for each feature.

Low Price		Medium Price		High Price	
Economy	76%	Dependability	75%	Dependability	75%
Dependability	72	Safety	65	Safety	65
Safety	66	Economy	59	Appearance	60
Comfort	44	Comfort	51	Comfort	57
Appearance	40	Appearance	45	Easy Control	49
Easy Control	33	Smoothness	39	Smoothness	35
Smoothness	32	Easy Control	38	Economy	34
First Cost	19	First Cost	9	First Cost	5

1. Which two items were liked by about the same number in each price class?

2. Why did "economy" receive a higher percentage of votes in the low-price class than in the high-price class?

3. Choose from the list of "desirable qualities" those items which are more popular with buyers in the low-price class than with buyers in the high-price class; less popular.

4. "What colour paint do you like on your car?" asked the manufacturer. Here are the replies:

Colour	Per Cent	Colour	Per Cent
Black	34	Dark green	8
Dark blue	14	Dark red	6
Dark gray	11	Light blue	6
Light gray	8	Light brown	5

Three other colours represented the remaining per cent.

a. What per cent represents all the colours?

b. What per cent to the eight colours listed represent?

c. What per cent do the remaining 3 colours represent?

CHANGING DECIMALS TO PER CENTS

Per cent, as you have learned, means **hundredths.** Therefore, a decimal may be changed to a per cent.

1. Change the following decimals to per cents:

a. .15; *b.* .06; *c.* .125; *d.* .6

a. .15 = 15% *c.* .125 = 12.5%
b. .06 = 6% *d.* .6 = .60 = 60%

To change a decimal to a per cent, move the decimal point two places to the right and annex the per cent sign (%).

Change the following decimals to per cents:

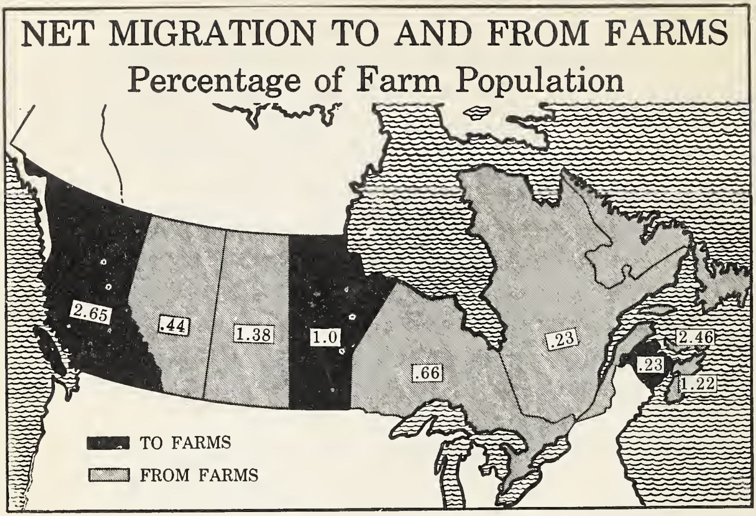
	a	*b*	*c*	*d*	*e*	*f*
2.	.43	.35	.01	.17	.25	.11
3.	.5	.1	.4	.9	.02	.7
4.	.125	.225	.625	.375	.8	.875
5.	.015	.025	.055	.035	.045	.05
6.	.75	.04	.3	.075	.12	.185

In each of the following examples, select the correct answer from the choices given.

7. .18 = 1.8%; 18%; 180%; .18%
8. .08 = 80%; .8%; 8%; .08%
9. .1 = 1%; .1%; 10%; .01%
10. .425 = 425%; 4.25%; .425%; 42.5%
11. .065 = 65%; .65%; 6.5%; 60.5%
12. .02 = 2%; .2%; 20%; .02%

*13. 7.5 = 75%; .75%; 7.5%; 750%

*14. 1.25 = 1.25%; 125%; 12.5%; .125%


NET MIGRATION TO AND FROM FARMS
Percentage of Farm Population
2.65
.44
1.38
1.0
.66
.23
.23
2.46
1.22
TO FARMS
FROM FARMS

BACK TO OR AWAY FROM THE FARM?

The map graph shows the per cent by provinces of our farm population which is moving to farms and away from farms. Areas in black show migration (moving from one place to another) **to** farms; areas in light shade show migration **from** farms.

Answer to puzzle problem, Page 81.

$$7 \times 7 + \frac{7}{7}$$

Prove that this is correct.

1. For the country as a whole, the migration from farms was 1% greater than the migration to farms. In which province was the migration from farms the greatest?

2. In which province was migration to farms the greatest?

3. In which provinces was farm migration least?

CHANGING PER CENTS TO DECIMALS

REMEMBER: **The sign, %, always means hundredths, or two decimal places.**

1. Study the following examples to see how per cents are changed to decimals: *a*. 12%; *b*. 3%; *c*. 2.5%; *d*. 40%.

a. 12% = .12	*c*. 2.5% = .025
b. 3% = .03	*d*. 40% = .40 = .4

To change a per cent to a decimal, drop the per cent sign and move the decimal point two places to the left.

Change the following per cents to decimals:

	a	*b*	*c*	*d*	*e*	*f*	*g*
2.	35%	18%	56%	98%	36%	55%	16%
3.	1%	9%	5%	7%	28%	2%	78%
4.	20%	10%	90%	50%	70%	43%	75%
5.	1.5%	3.5%	7.5%	15%	4.5%	6.5%	8.2%
6.	4%	68%	9.5%	8%	37.5%	12.5%	1.9%

In the following examples, select the correct answer from the numbers given.

7. 20% = 20; 2; .2; .02

8. 14% = .14; 1.4; 14; 140

9. 7.5% = 75; 7.5; .75; .075

10. 12.5% = 125; 12.5; 1.25; .125

11. 4% = .4; .04; 4; 40

12. A piece of cloth is advertised as "100% wool." What does that mean?

13. Tom said that he spent 50% of this month's earnings for a football. What other way could he have stated the same thing?

*14. A soap is advertised as $99\frac{44}{100}\%$ pure. How much more or less than one half of one per cent is the impurity?

FRACTIONS, DECIMALS, PER CENTS

1. Explain each step in changing the fractions $\frac{1}{4}$ and $\frac{1}{8}$ to per cents.

$$\frac{1}{4} = .25 = 25\% \qquad \frac{1}{8} = .125 = 12.5\%$$

2. Find the per cent equal to each of the following fractions: *a.* $\frac{1}{5}$; *b.* $\frac{3}{4}$; *c.* $\frac{3}{8}$; *d.* $\frac{4}{5}$; *e.* $\frac{7}{8}$; *f.* $\frac{3}{5}$; *g.* $\frac{7}{10}$; *h.* $\frac{7}{20}$.

3. Change $\frac{1}{3}$ to per cent.

$$\frac{1}{3} = .33\tfrac{1}{3} = 33\tfrac{1}{3}\%$$

a. Why was the decimal carried to two places?

b. Can the exact value of $\frac{1}{3}$ ever be written as a decimal? Explain.

4. Change $\frac{2}{3}$ to per cent.

5. Change 75% to a common fraction.

$$75\% = \frac{75}{100} = \frac{3}{4}$$

Why was 100 written as the denominator of the first fraction?

To change a per cent to a fraction, drop the per cent sign; write the number as a fraction having a denominator of 100; then reduce the fraction.

6. Change the following per cents to fractions:

a. 50% *b.* 20% *c.* 25% *d.* 60%
e. 40% *f.* 15% *g.* 30% *h.* 5%
i. 35% *j.* 80% *k.* 65% *l.* 45%

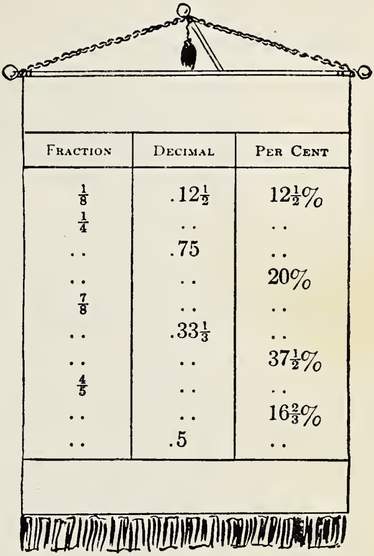
Memorize the fractional value of each of the following per cents.

$25\% = \frac{1}{4}$ $50\% = \frac{1}{2}$ $33\frac{1}{3}\% = \frac{1}{3}$
$75\% = \frac{3}{4}$ $20\% = \frac{1}{5}$ $66\frac{2}{3}\% = \frac{2}{3}$

*7. Show that the fraction $\frac{5}{6}$ is equal to $83\frac{1}{3}\%$; that the fraction $\frac{3}{16}$ is equal to $18\frac{3}{4}\%$.

RELATING FRACTIONS, DECIMALS, AND PER CENTS

Make a neat copy of the banner at the right. Find the missing numbers and fill in the empty places. Express the decimal form as hundredths.



FRACTION	DECIMAL	PER CENT
$\frac{1}{8}$	$.12\frac{1}{2}$	$12\frac{1}{2}\%$
$\frac{1}{4}$	. .	. .
. .	.75	. .
. .	. .	20%
$\frac{7}{8}$	. .	. .
. .	$.33\frac{1}{3}$	. .
. .	. .	$37\frac{1}{2}\%$
$\frac{4}{5}$	. .	. .
. .	. .	$16\frac{2}{3}\%$
. .	.5	. .

Fill the blanks in the following table:

FRACTION	DECIMAL	PER CENT
$\frac{3}{8}$	. .	.
. .	. .	50%
$\frac{1}{7}$	. .	. .
. .	.05	. .
. .	. .	6%
$\frac{7}{20}$	. .	. .
. .	24	. .
$\frac{3}{5}$	. .	. .
. .	. .	$3\frac{1}{3}\%$
$\frac{5}{9}$	. .	

Study example 1, and then find the numbers that should be in the blanks in the other examples. Do not use pencil and paper.

1. 4 is $\frac{1}{4}$, .25, 25% of 16
2. 3 is —, —, —— of 12
3. 2 is —, —, —— of 10
4. 6 is —, —, —— of 24
5. 8 is —, —, —— of 16
6. 5 is —, —, —— of 15
7. 7 is —, —, —— of 21
8. 7 is —, —, —— of 42
9. 6 is —, —, —— of 8
10. 9 is —, —, —— of 12
11. 2 is —, —, —— of 16
12. 6 is —, —, —— of 16
13. 20 is —, —, —— of 100
14. 16 is —, —, —— of 20
15. 7 is —, —, —— of 56
16. 7 is —, —, —— of 70

USING PER CENTS

1. Miss Smith reported that the attendance in her class was 100%. There were 40 pupils in the class. How many were present?

Think: 100% = 100 hundredths = $\frac{100}{100}$ = 1.00 = 1.
100% of 40 therefore equals 1 × 40 or 40.
100% present means all present.
100% of any number equals 1 times that number, or the number itself. 100% of anything means the whole of it.

2. A baseball team played 40 games and won 100% of them. How many games did the team win?

3. In a spelling test of 20 words, Julia had 100% correct. How many words did she spell correctly?

4. In an arithmetic test of 20 examples, Arthur had 20 examples correct. What per cent did he have correct?

5. State each of the following sentences in another way:

a. All pupils are present.
b. This coat is 100% rainproof.
c. This soap is 100% pure.
d. A sailboat sold for the same price as it cost.
e. All examples in a test were incorrect.

6. What is 100% of $5.20? 100% of $7.60?

7. If you earn $4.50 and spend all of it for a baseball mitt, what per cent of your earnings do you spend?

8. Is $.96 less than 100% of $2.00?

9. In a class of 20 boys; all were Boy Scouts. What per cent of the boys belonged to the Boy Scouts?

10. After a 4-yard piece of cloth had been washed and dried, it was still 4 yards in length. What per cent of the original length was the length after washing?

ADDING AND SUBTRACTING PER CENTS

Per cents may be added or subtracted just as we add or subtract other numbers.

1. In a spelling test Alice spelled 90% of the words correctly. What per cent did she misspell?

Think: All words = 100% of the words.
100% − 90% = 10%, the per cent misspelled.

2. In an arithmetic test John had 75% of the problems correct. What per cent of the problems were incorrect?

3. If $37\frac{1}{2}$% of the boys in a class are members of the Junior Boys' Club, what per cent are not members?

4. Harry bought a set of golf clubs for 25% less than the regular price. What per cent of the regular price did he pay for the set?

5. The price that Mr. Jackson paid for a used automobile was 75% of the regular price. What per cent less than the regular price did he pay for the automobile?

6. Mr. Smith increased the price of an article 25%. What per cent of the original price was the new price?

7. At the end of the month 15% of the class received a mark of "A" and 36% a mark of "B." What per cent of the class were marked "A" or "B"? What per cent of the class received other marks?

8. In a recent year 25.7% of all forest fires were caused by locomotive sparks and 18.4% by carelessness of campers. What per cent of all fires were due to these two causes? What per cent were due to other causes?

9. In a sixth-grade class 8% of the pupils are 10 years of age, 15% are 11 years of age, and 46% are 12 years of age. What per cent of the pupils are 10, 11, and 12 years of age? What per cent are not of these ages?

HOW TO FIND A PER CENT OF A NUMBER

1. Martin had a letter from a news company which stated that he could keep 20% of all money he collected from the sale of magazines. If he collected $3.50, how much was he to keep?

Martin's share was 20%. Amount collected was $3.50.

$3.50	Change 20% to .20
×.20	.20 × $3.50 = $.70
$.7000	Martin's share was $.70.

2. What is 4% of $72?

$72	Change 4% to .04
×.04	.04 × $72 = $2.88
$2.88	

These examples show that to find a per cent of a number, proceed as follows: (1) **change the per cent to a decimal**; (2) **multiply the number by the decimal.**

Find the following:

	a	*b*
3.	15% of 42 = ?	50% of 48 = ?
4.	3% of 250 = ?	2% of 85 = ?
5.	2% of 175 = ?	24% of 420 = ?
6.	10% of 50 bu. = ?	15% of 60 gal. = ?
7.	30% of $75 = ?	60% of 48 yd. = ?
8.	1% of $500 = ?	100% of $8 = ?
9.	14% of $860 = ?	3.5% of 120 mi. = ?

10. A radio news report stated that 60% of automobile accidents happen at night. If there were 3145 accidents in one month in this country, how many happened at night?

A SHORT CUT

You learned (page 130) how to find a per cent of a number by changing per cent to a decimal. Sometimes the work is easier if the per cent is changed to a fraction.

1. A sweater, priced regularly at \$4.80, was offered at 25% off. What was the amount of the reduction?

USING FRACTIONS

$25\% = \frac{1}{4}$

$\frac{1}{4}$ of \$4.80 =

$\frac{1}{4} \times \$4.80 = \$1.20$

USING DECIMALS

$25\% = .25$

$$\begin{array}{r} 4.80 \\ \times .25 \\ \hline 2400 \\ 9600 \\ \hline \$1.2000 \end{array}$$

The reduction was \$1.20. Which way is easier?

To find a per cent of a number, change the per cent to a decimal or to a fraction; then multiply the number by the decimal or by the fraction.

2. Would it be easier to use fractions or decimals in finding 38% of 92? in finding $33\frac{1}{3}\%$ of 96? Find each per cent by the method which you chose.

Use the easier method to find the following:

	a	*b*	*c*
3.	50% of 72 = ?	20% of 48 = ?	$33\frac{1}{3}\%$ of 270 = ?
4.	40% of 180 = ?	15% of 420 = ?	75% of 48 = ?
5.	$66\frac{2}{3}\%$ of 120 = ?	25% of 280 = ?	50% of 740 = ?
6.	18% of 310 = ?	5% of 490 = ?	2% of 1240 = ?
7.	23% of 1050 = ?	4% of 1450 = ?	$33\frac{1}{3}\%$ of 1860 = ?

8. Find 25% of \$450 by two different methods.

9. Find 50% of 930 bushels by two different methods.

10. Find $33\frac{1}{3}\%$ of \$750 by two different methods.

Age in Months	Ayrshire			Guernsey		
	Pounds	Gain in Month	% Gain	Pounds	Gain in Month	% Gain
Birth	72			65		
1	89	17	23.6	77	12	18.5
2	119	30	33.7	102	25	32.5
3	158	39	32.8	133	31	30.4
4	198	40	25.3	173	40	30.1
5	245	47	23.7	216	43	24.9
6	293	48	19.6	260	44	20.4
7	344	51	17.4	305	45	17.3
8	389	45	13.1	350	45	14.8
9	433	44	11.3	389	39	11.1
10	469	36	8.3	427	38	9.8
11	502	33	7.0	459	32	7.5
12	538	36	7.2	490	31	6.8
24	902	?		818	?	

JACK CHECKS HIS PRIZE CALVES

Jack is a member of a Calf Club. He is raising prize calves for yearling heifers. His stock should weigh about the same as certain dairy breeds listed in the table above.

1. What is the average weight at birth of an Ayrshire calf? of a Guernsey calf? of a Holstein calf? of a Jersey calf?

2. Which breed of calf gained the most weight during the first month? the least weight?

3. Which breed of calf showed the greatest per cent gain in weight during the first month? the smallest per cent gain?

4. The number of pounds gained each month by the Ayrshire increased until the calf was how old? by the Guernsey? by the Holstein? by the Jersey?

5. A normal yearling Ayrshire heifer should weigh about how many times as much as at birth? a Guernsey? a Holstein? a Jersey?

AGE IN MONTHS	HOLSTEIN			JERSEY		
	POUNDS	GAIN IN MONTH	% GAIN	POUNDS	GAIN IN MONTH	% GAIN
Birth	90			53		
1	112	22	24.4	67	14	26.4
2	148	36	32.1	90	23	34.3
3	193	45	30.4	121	31	34.4
4	243	50	25.9	158	37	30.6
5	297	54	22.2	199	41	25.9
6	355	58	19.5	243	44	22.1
7	410	55	15.5	286	43	17.7
8	462	52	12.7	324	38	13.3
9	509	47	10.2	360	36	11.1
10	552	43	8.4	393	33	9.2
11	593	41	7.4	420	27	6.9
12	632	39	6.6	450	30	7.1
24	1069	?		733	?	

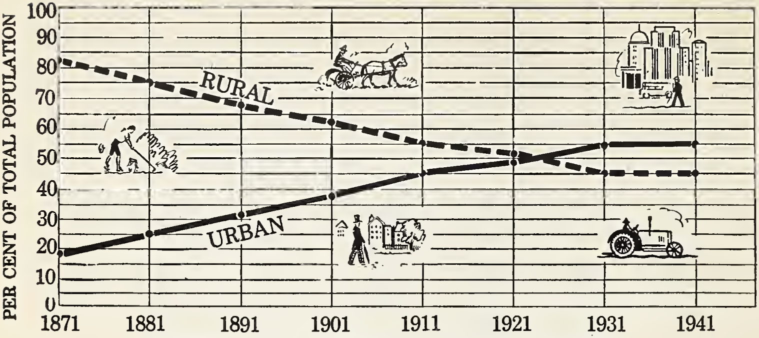
6. The normal weight for each breed, at age 24 months, is given in the table. How much did an Ayrshire calf gain during its second year? a Guernsey? a Holstein? a Jersey?

7. A yearling heifer needs 2.5 pounds of hay daily for each 100 pounds of weight. To the nearest pound, what is the quantity of hay which should be supplied daily to an Ayrshire yearling? a Guernsey? a Holstein? a Jersey?

8. A certain grain mixture, good for feed for yearling heifers, is 19% protein. If this mixture contains 510 pounds, how much protein does it contain? if the mixture contains 360 pounds?

9. Another grain mixture contains 13.3% protein. How much protein is in 420 pounds of the feed? 730 pounds?

*10. The actual gain during the fifth month for each breed was greater than during the fourth month. The per cent gain for the fifth month was less than for the fourth month. Why was this true?



RURAL AND URBAN POPULATIONS

In the early days of Canada, our population was largely **rural.** To-day it is increasingly city or **urban.** The graph shows the steady increase of urban over rural at 10-year periods from 1871 to 1941.

1. About what per cent of our population was rural in 1871? in 1901? in 1921? in 1941?

2. If you knew the per cent rural population for any year, how could you find the per cent urban population without using the graph?

3. In what year were the rural and urban populations the same? How is this shown on the graph?

4. In what year was the urban population equal to one fourth of the total population?

LET'S PRACTISE

⑫

	a	*b*	*c*
1.	$9 - 2\frac{3}{4} = ?$	$903 - 86 = ?$	$6087 \div 8 = ?$
2.	$2\frac{1}{2} \times \frac{5}{8} = ?$	$7\frac{1}{4} - 3\frac{5}{6} = ?$	$11 \times 9\frac{3}{4} = ?$
3.	$\frac{7}{8} \div \frac{3}{4} = ?$	$.6 \times 3.7 = ?$	$.03 \times 9.1 = ?$
4.	$6.5 \times 4.8 = ?$	$9688 \div 346 = ?$	$3.5 \div .01 = ?$
5.	36% of 50 = ?	5% of 45 = ?	1.5% of 180 = ?

6. Express as per cents: *a.* .6; *b.* $\frac{3}{4}$; *c.* .025; *d.* .125.

7. Express as decimals: *a.* 5%; *b.* 6.5%; *c.* 80%; *d.* 1%.

INSURING EFFICIENCY IN PERCENTAGE
FINDING YOUR WEAKNESSES

To be efficient, one must practise. Percentage is so important that you should spend a considerable amount of time in practice on the various types.

The following page gives you some interesting applications. Do not be content with anything but complete mastery. The tests will help you locate any weaknesses.

Set I

1. Express the following as per cents:

a. .04 =
b. .17 =
c. .75 =
d. .625 =
e. .5 =
f. $.37\frac{1}{2}$ =
g. .4 =
h. $.66\frac{2}{3}$ =
i. .035 =
j. .175 =
k. .35 =
l. .6 =

2. Express the following in decimal form:

a. 7% =
b. 12.5% =
c. 18% =
d. 20% =
e. 17% =
f. $33\frac{1}{3}$% =
g. 16.4% =
h. 3% =
i. $58\frac{1}{2}$% =
j. 30% =
k. $2\frac{1}{2}$% =
l. 3.4% =

3. Express the following as hundredths and as per cents:

a. $\frac{1}{2}$ = .50 = 50%.
b. $\frac{1}{5}$ = — = —%
c. $\frac{8}{25}$ = — = —%
d. $\frac{3}{50}$ = — = —%
e. $\frac{5}{8}$ = — = —%
f. $\frac{5}{6}$ = — = —%

Set II

Find the answers to the following:

1. 4% of 80 =
2. 10% of 860 =
3. 12.5% of 640 =
4. $33\frac{1}{3}$% of 84 =
5. 14% of 1,000 =
6. $2\frac{1}{2}$% of 600 =
7. 7.5% of 200 =
8. 20% of 36 =
9. 100% of 200 =
10. 12% of 640 =
11. 1% of 480 =
12. $33\frac{1}{3}$% of 900 =
13. 19.5% of 2,000 =
14. 21% of 1,000 =

FINDING THE RATIO OF TWO NUMBERS

1. A school baseball team played 12 games and won 9. What per cent of the games played did the school win?

To find what per cent of games was won, compare 9 with 12.

$\frac{9}{12} = \frac{3}{4}$. The team won $\frac{3}{4}$ of the games played.

$\frac{3}{4} = .75 = 75\%$. The team won 75% of its games.

2. Six days during November had rain. What per cent of the days of the month was rainy?

There are 30 days in November. To find the per cent of rainy days, compare 6 with 30.

$\frac{6}{30} = \frac{1}{5}$. It rained $\frac{1}{5}$ of the days of the month.

$\frac{1}{5} = .2 = 20\%$. It rained on 20% of the days.

3. If rain fell on 20% of the days during November (problem 2), what per cent of the days had clear weather?

4. Grace scored 11 points in basketball out of 25 shots at the basket. What per cent of her trials was successful?

a. What was the number of goals scored?

b. What was the number of trials?

The ratio of the number of goals to the number of trials is $\frac{11}{25}$. $\frac{11}{25} = .44 = 44\%$.

c. If 44% of the trials was successful, what per cent of the trials was unsuccessful?

$$\begin{array}{r} .44 \\ 25\overline{)11.00} \\ \underline{10\,0} \\ 100 \\ \underline{100} \end{array}$$

To find what per cent one number is of another, find what fractional part one number is of the other and change this fraction to hundredths and then to a per cent.

LET'S PRACTISE PERCENTAGE

⑬

Set I

	a	b	c
1.	4 = ? % of 8	4 = ? % of 12	15 = ? % of 30
2.	6 = ? % of 60	20 = ? % of 50	9 = ? % of 100
3.	12 = ? % of 25	13 = ? % of 50	2.5 = ? % of 10
4.	15 = ? % of 20	15 = ? % of 25	9 = ? % of 27
5.	18 = ? % of 24	24 = ? % of 36	5 = ? % of 5
6.	17 = ? % of 34	40 = ? % of 160	7 = ? % of 10
7.	9 = ? % of 90	14 = ? % of 56	35 = ? % of 105
8.	10 = ? % of 40	30 = ? % of 150	90 = ? % of 270

Set II

1.	10% of 80 = ?	25% of 96 = ?	5% of 72 = ?
2.	1% of 100 = ?	40% of 120 = ?	12% of 45 = ?
3.	50% of 430 = ?	100% of 58 = ?	75% of 200 = ?
4.	30% of 1000 = ?	2% of 250 = ?	14% of 65 = ?
5.	$33\frac{1}{3}$% of 750 = ?	25% of 600 = ?	$66\frac{2}{3}$% of 96 = ?
6.	3% of $50 = ?	2% of $80 = ?	1.5% of $50 = ?
7.	2.5% of $100 = ?	3.5% of $600 = ?	4.5% of $200 = ?
8.	1.5% of 1000 = ?	100% of 7.8 = ?	45% of $200 = ?

Set III

1.	8 = ? % of 24	13 = ? % of 65	40 = ? % of 50
2.	9% of 650 = ?	12% of 120 = ?	20% of 420 = ?
3.	65 = ? % of 130	2.5% of 1000 = ?	24% of 350 = ?
4.	17 = ? % of 68	29 = ? % of 87	26% of 700 = ?
5.	1% of 900 = ?	1.5% of 200 = ?	8 = ? % of 50
6.	7 = ? % of 35	12 = ? % of 100	4% of 85 = ?
7.	100% of 28 = ?	16 = ? % of 16	5% of 132 = ?

8. Show that 10% of 750 is the same as 20% of 375.

USING PER CENT

1. If there are 16 boys in a class of 40 pupils, what per cent of the class is boys? is girls?

2. A family with an income of \$2250 spends 32% of it for food. How much does this family spend for food?

3. If a basketball team played 20 games and won 17, what per cent of the games did the team win? What per cent of the games did the team lose?

4. If milk contains 3.5% butterfat, find the amount of butterfat in 1200 pounds of milk.

5. Forest fires account for about 11% of the annual depletion of Canada's standing timber. If the total depletion in a recent year was 2,800,000 bd. ft., what was the loss by fire?

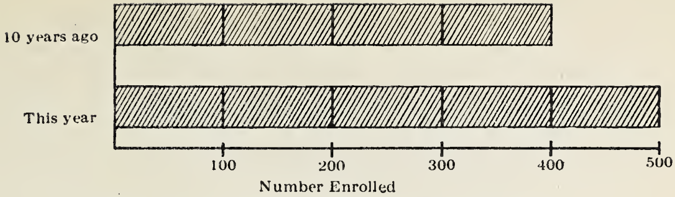
6. One foot is what per cent of a yard?

LET'S PRACTISE

14

Copy and work each of the following examples. Check by going over your work.

	a	*b*	*c*
1.	$7 \times 309 = ?$	$465 \div 8 = ?$	$6015 - 3028 = ?$
2.	$5406 \div 9 = ?$	$.76 \times 38.5 = ?$	$9\frac{1}{4} + 3\frac{7}{8} + 4\frac{5}{6} = ?$
3.	$11\frac{3}{8} - 4\frac{5}{6} = ?$	$1\frac{1}{2} \times 9\frac{1}{4} = ?$	$15 \div 2\frac{1}{2} = ?$
4.	$.56 \times 4.8 = ?$	$.25 \times .25 = ?$	$4.6 \div 100 = ?$
5.	$\frac{7}{8} \div 4 = ?$	$\frac{5}{8} \times 3\frac{1}{3} = ?$	$1728 \div .36 = ?$
6.	$1 \div \frac{8}{9} = ?$	$14\frac{2}{3} - 6\frac{3}{4} = ?$	$308 \times 2009 = ?$
7.	6% of \$750 = ?	18 = ? % of 72	25% of 964 = ?
8.	$.763 + 7.805 + 6.795 + .005 = ?$		
9.	$3\frac{3}{4} + 2\frac{1}{2} + 9\frac{7}{8} + 3\frac{5}{16} + 4\frac{3}{8} = ?$		



PER CENTS GREATER THAN 100%

The numbers of pupils enrolled in the McDougall School 10 years ago and to-day are pictured in the graph.

1. The bar graph which represents enrolment 10 years ago is divided into four equal parts. As the whole of a thing is 100 per cent of it, each of these equal parts represents how many per cent of the enrolment 10 years ago?

2. The enrolment to-day is how much greater than the enrolment 10 years ago?

3. The increase in enrolment this year is what part of the enrolment 10 years ago? what per cent?

4. The increase was 25% of the original enrolment. This year's enrolment, therefore, is 125% of the enrolment 10 years ago. Explain.

5. The enrolment 10 years ago is what per cent of this year's enrolment?

6. Change to per cents: *a.* 1.25; *b.* 2.4; *c.* 2; *d.* 1.025.

a. **1.25 = 125%**
b. **2.4 = 2.40 = 240%**
c. **2 = 2.00 = 200%**
d. **1.025 = 102.5%**

7. Change to per cents: *a.* 1.5; *b.* 3; *c.* $2\frac{1}{2}$; *d.* 2.25; *e.* 1.04.

8. Work each of the following examples:

a. 150% of 60
b. 225% of 300
c. 104% of 500
d. 10 = ? % of 5
e. 75 = ? % of 25
f. 500 = ? % of 200
g. 200% of 32
h. 120% of 80
i. 250% of 75
j. 100 = ? % of 25
k. 100 = ? % of 75
l. 25 = ? % of 20

MAGAZINE AND RADIO ADVERTISING

Some advertisements which you see in magazines or hear over the radio contain crisp statements—very brief and sometimes incomplete in order to save costly advertising space or radio time. A manufacturer of gasoline, for example, described his product as "25 per cent more powerful." His statement was incomplete. A **per cent** must compare **two** items. It must show the ratio of one number to another.

"THE TIRES WILL LAST 50% LONGER"

1. Complete the statement, "It is 25 per cent more powerful," to give a true meaning of per cent.

2. The following statements were taken from newspaper advertisements. (The words in parentheses indicate the product.) Copy and complete each statement in order to show the true meaning of per cent.

a. "Lasts 20 per cent longer" (razor blades)

b. "Contains 26 per cent more space" (refrigerator)

c. "Develops 20 per cent more power" (automobile)

d. "Holds 104 per cent more ink" (fountain pen)

e. "Holds heat 50 per cent longer" (gas range oven)

f. "Gives off 15 per cent less heat" (light bulb)

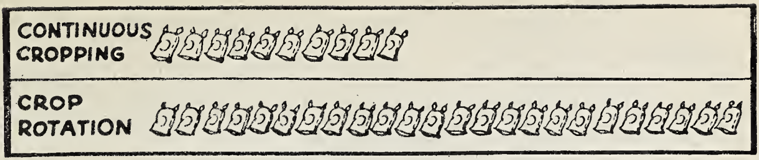
g. "Lasts 25 per cent longer and costs 25 per cent less" (permanent wave)

h. "Makes cakes rise 15 per cent higher" (baking powder)

i. "Washes table linens to a snowy white in 25% less time" (soap)

j. "Uses 20% less gasoline" (automobile)

*3. A manufacturer advertised his product as "$99\frac{44}{100}\%$ pure." Tell why this is a complete statement.



MORE WHEAT AN ACRE

In one field, wheat only was planted (**continuous cropping**); in the next field, crop rotation was practised.

1. What was the increased yield (see graph), in number of bushels, resulting from crop rotation?

The per cent increase is found by comparing the increase, 14 bushels, with the yield an acre for the first field, 10 bushels. $\frac{14}{10} = 1.4 = 140\%$

To find the per cent increase of one amount over another: **Find the difference between the numbers and compare this difference with the smaller number.**

2. If land is planted only to wheat, the average yield will be 21 bushels an acre. If wheat is rotated with other crops, the average yield will be 39 bushels. Find the per cent increase due to crop rotation.

3. If the price of eggs in April is 18¢ a dozen and in December, 45¢, what is the per cent increase?

4. Last year, George weighed 90 pounds. This year he weighs 100 pounds. What was the per cent increase?

5. If the population of a city doubled in 20 years, what was the per cent increase? This year's population is what per cent of the population 20 years ago?

6. Find the per cent increase when the increase is from:

a. 50 to 75
b. 60 to 75
c. 15 to 20
d. 30 to 100
e. 700 to 2100
f. 40 to 90
g. 25 to 75
h. 6 to 10
i. 1000 to 1100
j. 800 to 1000
k. 50 to 150
l. 100 to 300

NEW POTATOES
Special
45¢ Pk.
usually
50¢

SPECIALS GET THE BUSINESS

Merchants often have "special sales" to attract new customers to their stores.

1. At a special sale, new potatoes, regularly priced at 50¢ a peck, were marked at 45¢. What per cent was saved by buying at the special sale?

The saving was 5¢. This amount is compared with 50¢. What per cent of 50¢ is 5¢?

2. Find the per cent saving in the following articles purchased at a special sale.

ARTICLE	REGULAR PRICE	SALE PRICE	PER CENT SAVING
Canned peaches	21¢	18¢	?
Canned tomatoes	12¢	10¢	?
3 bars of soap	30¢	25¢	?
1 lb. prunes	14¢	12¢	?

3. Potatoes sold at 70¢ a bushel or 20¢ a peck. What was the saving by the bushel? the per cent saving?

4. Fresh maple syrup sold at the following prices:

1 pint can, 55¢	2 quart can, $1.65
1 quart can, 90¢	1 gallon can, $3.00

What per cent cheaper was a gallon can of this syrup than the same quantity in pint cans? in quart cans?

5. Why is syrup cheaper by the gallon than by the pint?

★6. List 10 different articles on sale at your local grocery which can be purchased more cheaply in large quantities than in small quantities. Be sure to give the price of each article bought in quantity; singly; and the per cent saving.

⋆FINDING APPROXIMATE PER CENTS

1. The Western School has an enrolment of 527 pupils, of which 268 are boys. The number of boys is what per cent of the number enrolled, to the nearest tenth of a per cent?

```
       .5085 = 50.85%
527)268.0000
    263 5
      4 500
      4 216
        2840
        2635
         205
```

Note that per cent boys cannot be found exactly as a decimal. The approximate per cent must be used.

50.85% = 50.9% to the nearest tenth of a per cent.

The number of boys is 50.9% of the number enrolled.

To find a per cent to the nearest tenth of a per cent, carry the work to four decimal places. If the figure in the fourth place is 5 or more, make the figure in the third place one more. When the figure in the fourth place is less than 5, drop it.

To the nearest tenth per cent:

2. 1 = ? % of 3
3. 12 = ? % of 26
4. 110 = ? % of 90
5. 2 = ? % of 7
6. 35 = ? % of 27
7. 90 = ? % of 110

8. How can you find what per cent one number is of another to the nearest whole per cent? To how many decimal places should the ratio between the numbers be carried?

9. Show that 15 is 83% of 18 to the nearest whole per cent.

To the nearest whole per cent:

10. 15 is ? % of 16
11. 5 is ? % of 12
12. 75 is ? % of 32
13. 3 is ? % of 8
14. 30 is ? % of 21
15. 400 is ? % of 300

LET'S PRACTISE PERCENTAGE

15

Without the use of paper and pencil, express the missing numbers in Sets I and II.

Set I

1. 10% of 40 = ?
2. 200% of 8 = ?
3. 25% of 16 = ?
4. 20% of 50 = ?
5. 300% of 10 = ?
6. 100% of 12 = ?
7. 50% of 60 = ?
8. 1% of 100 = ?
9. $33\frac{1}{3}$% of 150 = ?
10. 75% of 40 = ?

Set II

1. 4 = ? % of 8
2. 8 = ? % of 4
3. 3 = ? % of 100
4. 10 = ? % of 30
5. 75 = ? % of 100
6. 3 = ? % of 12
7. 7 = ? % of 7
8. 5 = ? % of 25
9. 6 = ? % of 9
10. 100 = ? % of 50

Set III

1. 6% of 25 = ?
2. 125% of 36 = ?
3. 2% of 18 = ?
4. 15 = ? % of 80
5. 2.5% of 750 = ?
6. 12.5% of 40 = ?
7. 5% of 160 = ?
8. 13 = ? % of 42
9. 220% of 72 = ?
10. 103% of 450 = ?
11. 90 = ? % of 60
12. 25 = ? % of 40
13. 9 = ? % of 15
14. 100 = ? % of 125

15. To the nearest hundredth, find the decimal value of: ***a.*** $\frac{1}{3}$; ***b.*** $\frac{5}{6}$; ***c.*** $\frac{1}{8}$; ***d.*** $\frac{6}{7}$; ***e.*** $\frac{8}{9}$; ***f.*** $\frac{5}{16}$; ***g.*** $\frac{8}{11}$; ***h.*** $\frac{4}{9}$.

16. About 15 adult persons out of each 100 can get a loan of money from a bank. What per cent is that? To what per cent of our population will banks not lend?

17. A certain grade of milk is 3.5% butterfat. At that rate, how much butterfat is in 450 pounds of this milk?

USES OF PER CENT

1. William saves 25% of his earnings. If he earns $1.80 each week delivering papers, how much does he save?

2. A garage offered a 20% reduction in price on repair work during April. The regular price for each job is given. Find the April price.

a. Reline brakes......	$8.50	*c.* Grind valves......	$12.40
b. Refinish fenders ...	$7.50	*d.* Replace tires......	$19.75

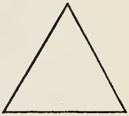
3. The records of eight leading football teams over a period of 5 years were as follows:

TEAM	WON	LOST	TIED*	PERCENTAGE
Bombers	40	4	3	.909
Argos	40	5	4	?
Wildcats	40	5	4	?
Rough Riders	35	5	0	?
Stampeders	40	7	1	?
Marlboroughs	37	7	3	?
Rams	29	6	7	?
Blues	35	8	3	?

*Tied games are counted as "Not Played."

Find the standing of each team. Express the result to 3 places (corrected from 4 places).

4. The side of a square is what per cent of its perimeter (distance around)?



5. Here is a triangle. All its sides are equal in length (equilateral). A side is what per cent of the perimeter of the triangle?

6. A dealer is given 24% of the price of a car for selling. If the car sold for $860, what is the dealer's share?

7. A poultryman put 1400 eggs into incubators. He expected 96% to hatch. At that rate, how many baby chicks should he get?

DIAGNOSTIC TEST IN PER CENT

Use this test to find the steps in per cent on which you may need more practice.

I. Reading and Writing Per Cents

1. Express as per cents: .08, .25, .2, $\frac{17}{100}$, $\frac{7}{10}$. (123)

2. Express as per cents: 1.35, 1.045, 1.3, $1\frac{18}{100}$. (123)

3. Express as decimals: 12%, 8%, 27.5%, $12\frac{1}{2}$%, 115%, 2.5%, 140%. (125)

4. Express as fractions: 25%, 20%, 75%, $33\frac{1}{3}$%, $66\frac{2}{3}$%, 50%, 40%. (126)

5. How much less than the whole is 80% of a thing? (121)

II. Finding a Per Cent of a Number (130–131)

	a	*b*	*c*
1.	6% of 450 = ?	8% of 780 = ?	4% of 96 = ?
2.	12% of 758 = ?	48% of 650 = ?	97% of 820 = ?
3.	16.5% of 800 = ?	12.5% of 640 = ?	37.5% of 640 = ?
4.	20% of 750 = ?	10% of 458 = ?	40% of 879 = ?
5.	105% of 960 = ?	120% of 780 = ?	140% of 768 = ?
6.	$33\frac{1}{3}$% of 60 = ?	$66\frac{2}{3}$% of 90 = ?	25% of 84 = ?

III. Finding What Per Cent One Number Is of Another (136)

	a	*b*	*c*
1.	2 = ?% of 8	30 = ?% of 40	288 = ?% of 800
2.	3 = ?% of 15	40 = ?% of 100	216 = ?% of 360
3.	4 = ?% of 80	6 = ?% of 200	25 = ?% of 500
4.	9 = ?% of 27	12 = ?% of 96	45 = ?% of 72
5.	8 = ?% of 28	14 = ?% of 78	84 = ?% of 96
6.	120 = ?% of 80	125 = ?% of 75	240 = ?% of 200

If you had more than one incorrect example in each row of examples, review the page keyed in parentheses. Then correct your work on the test.

⋆TOPSY-TURVY MAGIC SQUARE

Below is a topsy-turvy magic square. You can read the number in each cell. If you turn your book upside down, you can still read the number in each cell. Try it.

1. With the book in its regular position, see if the sum of the numbers in each row, each column, and either diagonal is the same.

2. Invert the book and see if a magic square is still formed.

3. Check to see whether each of the four quarters of this square forms a magic square.

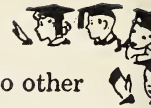
4. Select a number in any cell in one quarter and the number in the corresponding cell in each of the other three quarters. For example, select 689 in the upper left quarter. The number in the corresponding cell in the quarter below is 991; the number in the corresponding cell in the lower right quarter is 816; the number in the corresponding cell in the remaining quarter is 168. What is the sum of these four numbers?

Select numbers from 4 other corresponding cells. Add. What do you find?

916	191	869	688	891	616	988	169
868	689	911	196	989	168	896	611
681	866	198	919	166	981	619	898
199	918	686	861	618	899	161	986
668	889	111	996	189	968	696	811
116	991	669	888	691	816	188	969
999	118	886	661	818	699	961	186
881	666	998	119	966	181	819	698

By Royal V. Heath

HOW WELL DO YOU REMEMBER?



1. Write the value of the following fractions in two other ways: *a.* $\frac{1}{2}$; *b.* $\frac{1}{4}$; *c.* $\frac{4}{5}$; *d.* $\frac{3}{4}$.

2. How do you find a per cent of a number? Find 12% of 540; 3% of $125.

3. How do you find what per cent one number is of another? Find what per cent 12 is of 36. What per cent of 15 is 12?

4. What is meant by "team standing"? Find the team standing of a baseball team which won 11 games and lost 5.

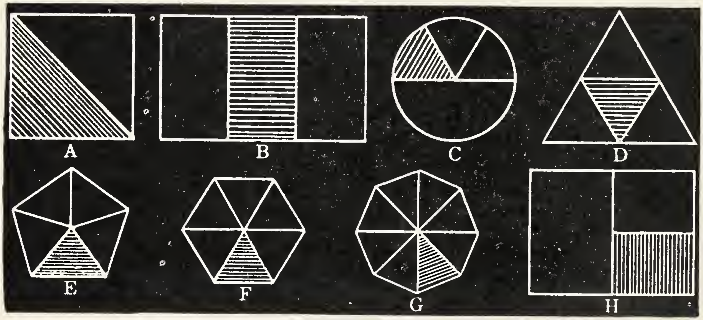
5. Ten years ago, 120 hours were required to send a parcel by railway express from coast to coast; to-day, 96 hours. What is the reduction in time? the per cent reduction?

6. In March the price of a dozen oranges was 25¢; in June, 39¢. What was the increase? the per cent increase?

7. What is faulty with the following advertisement of an oil burner: "Saves 20%"?

8. What is meant by the statement, "Canada produces almost 100% of the world's asbestos."

9. What per cent of the area is shaded in each of the figures shown?



THINGS TO REMEMBER

1. *How our population is changing.*
2. *The meaning of per cent.*
3. *How to change a decimal or a common fraction to a per cent.*
4. *How to change a per cent to a decimal or a common fraction.*
5. *How to find a per cent of a number.*
6. *How to find what per cent one number is of another.*

TEST ON CHAPTER V

1. Write the following as per cents: *a.* .42; *b.* $\frac{1}{2}$; *c.* .03; *d.* $\frac{1}{3}$; *e.* 2.25; *f.* .025; *g.* .1.

2. Change the following per cents to decimals: *a.* 14%; *b.* 40%; *c.* 125%; *d.* 6%; *e.* 1.5%.

3. Change the following per cents to common fractions: *a.* 25%; *b.* $66\frac{2}{3}\%$; *c.* 75%; *d.* 20%; *e.* 50%.

4. State what is incomplete in the following advertisement for an automobile tire: "Wears 20% longer."

5. If milk contains 4% butterfat, find the number of pounds of butterfat in 1650 pounds of milk.

6. The price of a camera was reduced from $6 to $4.50. What was the per cent reduction?

7. Last year a family spent $800 for food. This year the cost of food was $920. What was the per cent increase?

8. Write 75% in two other ways.

9. A news item reported that Canada has:

   a. 7% of the land area of the world
   b. $\frac{1}{2}\%$ of the world's population
   c. 38% of the newsprint of the world
   d. $3\frac{1}{3}\%$ of the telephones of the world
   e. 13% of the gold of the world

What per cent of each item is not found in Canada?

*TOPICS FOR SPECIAL REPORTS

1. The average length of life of people is called their "**life expectancy**." The life expectancy of a person to-day is about 60 years; 100 years ago his expectancy was about 40 years. What are some of the things which brought about a greater life expectancy?

2. How does the increase in the life expectancy of people affect the number of old people in a given population?

3. What provision has our Federal Government made to assure an income for old people?

4. Many provinces have laws prohibiting child labour. What is the age at which a child is permitted to work in your province?

5. How does the number of children employed affect the number of jobs for persons over 40 years of age?

6. Make a collection of the uses of per cent found in the headlines of a daily newspaper.

7. John said, "Per cent is a standard way of comparing numbers." What did he mean? Was he correct?

8. Show that there can be as much as 100% increase in the cost of an article. Now show that there can never be 100% decrease in its cost.

9. A man received a 10% increase in wages; then he received a 10% decrease in wages. Show that he received less after his decrease than he received before he was given an increase.

10. From a history of mathematics, find the history of the use of the per cent sign.

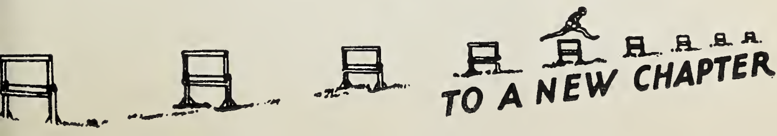
11. Since per cent is only another way of writing hundredths, why do you think the per cent notation is used?

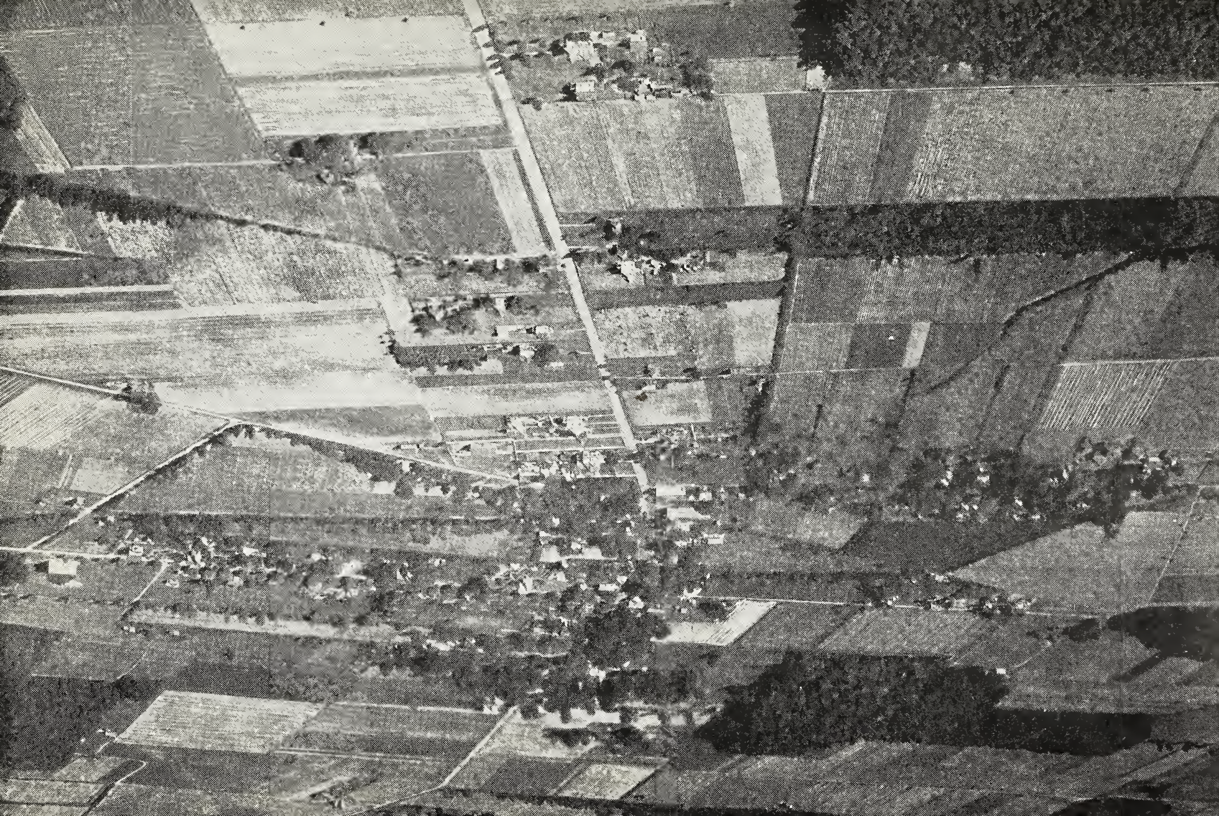
PROGRESS TEST

Solve the problems and perform the indicated operations. If you make errors on this test, turn to the pages keyed in parentheses where the work is explained.

1. $40103 - 9106 = ?$ (11)
2. $76 \times 395 = ?$ (15)
3. $8015 \div 9 = ?$ (22)
4. $4\frac{5}{6} \times 27 = ?$ (48)
5. $11\frac{1}{8} - 4\frac{5}{6} = ?$ (46)
6. $17.5 \div 100 = ?$ (75)
7. $2\frac{1}{2} \div 8\frac{1}{4} = ?$ (54)
8. $3.5 \times 6.87 = ?$ (70)
9. 250% of 60 = ? (130)
10. 30 = ? % of 20 (136)
11. $7.48 + 9.56 + 3.09 + 1.45 + 6.27 = ?$ (66)
12. $7\frac{1}{2} + 2\frac{1}{3} + 4\frac{1}{4} + 8\frac{1}{6} + 6\frac{2}{3} = ?$ (43)
13. How much are 8 gal. 3 qt. and 4 gal. 2 qt.? (9)
14. From 12 ft. 4 in. subtract 3 ft. 9 in. (11)
15. How many pieces $\frac{3}{4}$ yard long can be cut from piece of cloth 18 yards long? (54)
16. Write 3 hr. 15 min. as 3.? hours. (88)
17. Write the decimal value of: *a.* $\frac{1}{5}$; *b.* $\frac{3}{4}$; *c.* $\frac{3}{8}$; *d.* $\frac{9}{25}$; *e.* $\frac{4}{5}$; *f.* $\frac{1}{2}$; *g.* $\frac{7}{8}$. (76)
18. Write 136 with Roman numerals. (64)
19. Give the place value of each figure in the number 123.54. (65)
20. Make a bar graph to show the increase in population in this country for ten-year periods as given. The amounts are rounded off to the nearest hundred thousand.

1891	500,000	1921	1,600,000
1901	600,000	1931	1,500,000
1911	1,900,000	1941	1,200,000





CHAPTER VI

SQUARES AND RECTANGLES

Refer to the picture on page 152. Find a square; a rectangle. How many sides has each of these geometric figures? Which figure has four equal sides? two pairs of equal sides, one pair of sides longer than the other pair?

Note how the sides join. The opening between any pair of sides is an **angle.** All angles of the square or the rectangle form **square** corners. Such angles are called **right angles.**

1. Decide whether each of the following statements is correct or incorrect:

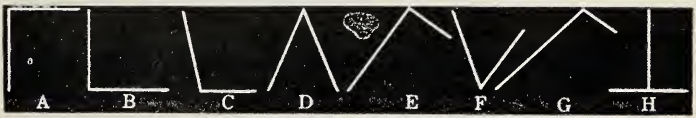
   a. A rectangle is a four-sided figure with four right angles.
   b. All squares are rectangles.
   c. Not all rectangles are squares.

2. List illustrations of squares and rectangles in your classroom.

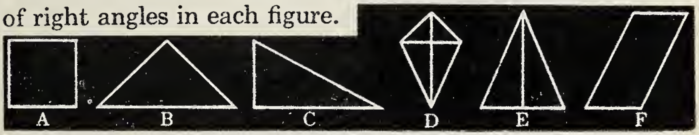
3. Are the panes of glass in the windows of your school square or rectangular? Explain.

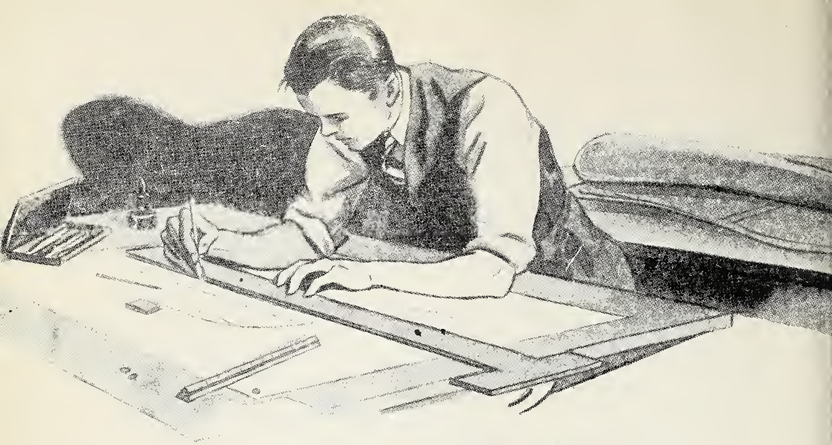
4. If a tennis court is marked for "doubles," are squares or rectangles formed by the boundary lines?

5. Which of the following geometric figures are right angles:



6. Each of the following geometric drawings may have one or more right angles or none at all. Count the number of right angles in each figure.





A DRAFTSMAN'S TOOLS

One of Jim's courses in high school is mechanical drawing. Here we see him at work with **drawing board, T-square,** and **triangular ruler.** Find these tools in the picture.

1. What kind of geometric figure is the surface of Jim's drawing board? How many right angles can you count on the surface of Jim's T-square?

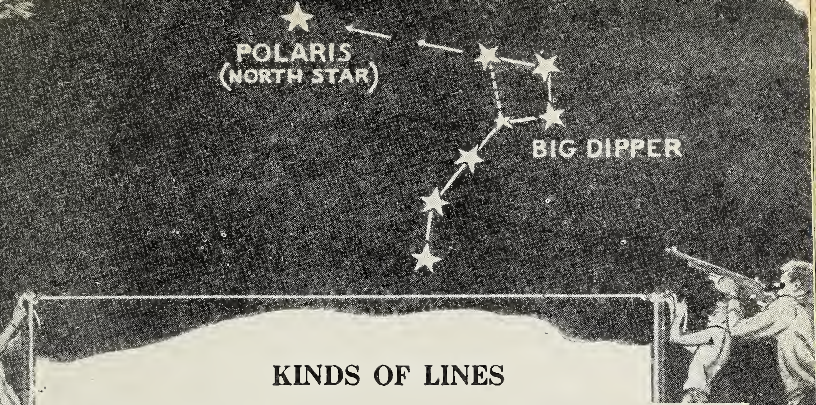
2. There are right angles even on Jim's triangular ruler. How many can you find?

LET'S PRACTISE ⑯

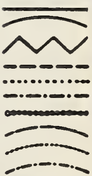
	a	*b*	*c*
1.	$703 \times 9006 = ?$	$34056 - 14075 = ?$	$32748 \div 365 = ?$
2.	$7\frac{3}{5} \times 9\frac{1}{6} = ?$	$7\frac{3}{4} \div 2\frac{1}{8} = ?$	$16\frac{1}{4} - 7\frac{5}{6} = ?$
3.	$92.7 \div .03 = ?$	$6.3 \times 4.87 = ?$	$.950 - .943 = ?$
4.	18% of $750 = ?$	210% of $1400 = ?$	3.5% of $420 = ?$
5.	$27 = ?\ \%$ of 30	$80 = ?\ \%$ of 20	$15 = ?\ \%$ of 18

6. Express as per cents: ***a.*** .56; ***b.*** .03; ***c.*** .1; ***d.*** 1; ***e.*** 2.5; ***f.*** 1.25; ***g.*** $\frac{1}{2}$; ***h.*** $\frac{3}{4}$; ***i.*** 1.025.

7. Express as common fractions: ***a.*** 25%; ***b.*** $33\frac{1}{3}\%$; ***c.*** 50%; ***d.*** 40%; ***e.*** $66\frac{2}{3}\%$; ***f.*** 75%; ***g.*** 20%.



KINDS OF LINES



There are many kinds of lines, but all of them may be grouped either as **straight** or **curved.** A broken line, for example, is short pieces of straight line joined; a dot line may be a row of tiny circles. Name several other kinds of lines. Then classify each as straight or curved.

1. The two boys are stretching a clothesline tightly between two posts. What kind of line will they form? **Two points, therefore, determine a straight line.**

2. The rifle has two "sights." How do they aid in accurate marksmanship?

3. Mark 3 dots on a paper. Draw a straight line through these dots. Were you able to do so? If not, mark 3 dots through which a straight line **can** be drawn. Tell when a straight line can be drawn through three points and when it cannot.

4. The picture shows the constellation Ursa Major (The Great Bear) or "The Big Dipper." The two stars on the side of the cup opposite the handle are called the "pointers." Why are they so named?

*5. The North Star and the pointer stars are in the same straight line. Check this statement against the picture.

SEGMENTS OF A LINE

A line has no fixed length. The part of a line between any two points, such as AB, is called a **segment.** **A————B**

1. Draw a segment of a line 3 inches in length.

Mark any point on your paper, point *A*. Place the edge of your ruler so that point *A* will be at one of the inch divisions. Then, with a sharp-pointed pencil, draw a line along the edge of the ruler. Mark a point, *B*, on this line three inches from the first point. The segment *AB* should be 3 inches in length.

a. Your work will be more accurate if the end of the ruler is not placed at point *A*. State why this is true.

b. If point *A* is placed at the 1-inch mark on the ruler, and the segment is 3 inches long, where is point *B* along the ruler's edge?

2. Draw segments of lines having the following lengths:

a. 2 in.; *b.* 4 in.; *c.* $2\frac{1}{2}$ in.; *d.* $3\frac{1}{2}$ in.; *e.* $1\frac{3}{4}$ in.

3. Draw a segment of a line which you think is 4 inches long. Then measure it. Were you able to guess correctly to within half an inch?

4. Select two points on your paper which you think are 6 inches apart. Draw a line between these points and measure it. Were you able to guess correctly to within one inch? If not, try again until you can guess a 6-inch distance within one inch error either way.

If you guessed $6\frac{3}{4}$ inches, how much nearer than one-inch accuracy were you?

5. A point should be marked with a very short dash at right angles with a given line. If the dash is made by a blunt-pointed pencil, how will that affect the accuracy of the work?

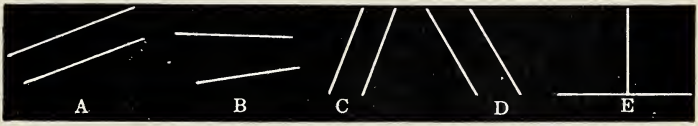
PARALLEL LINES

If two lines are the same distance apart through their entire length, they are said to be **parallel.**

1. Why must the rails of a railroad track be parallel?

2. List illustrations of parallel lines in your classroom.

3. State which of these pairs of lines are parallel; are not parallel.



4. Point to several illustrations of parallel lines in the picture below.

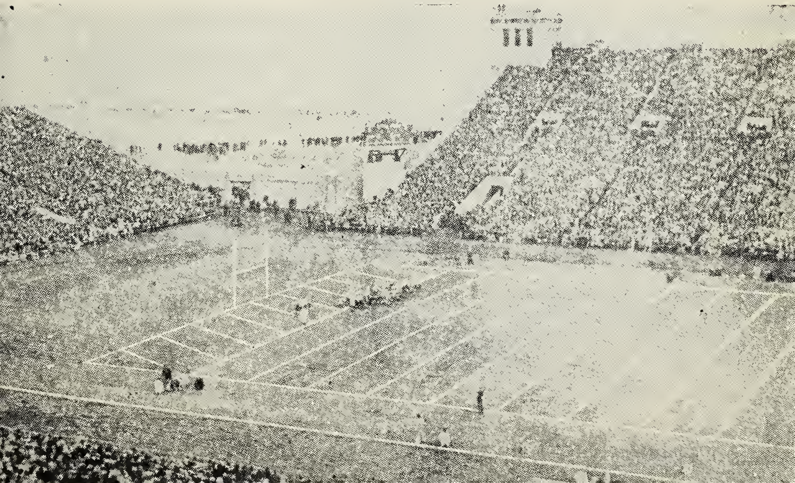
5. Find illustrations of rectangles in the picture.

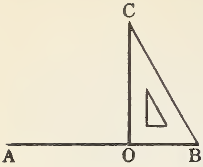
6. Decide whether the two statements which follow are correct:

a. The opposite sides of a rectangle are parallel.

b. The opposite sides of a rectangle are equal in length.

7. If a figure of four sides does not have its opposite sides equal, is it a rectangle? Make a drawing to show that your answer is correct.





USING A DRAFTSMAN'S RULER

If two lines meet so as to form right angles, the lines are **perpendicular** to each other.

1. Draw a line perpendicular to AB at the point O.

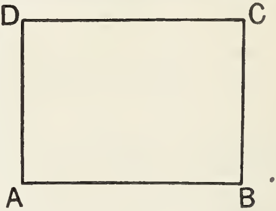
Draw a line, AB, and mark any point on it, as the point O. Place the square corner of a **draftsman's ruler** or **triangle** at the point, O, so that one side of this triangle is along the line, OB. Draw a line from O along the other edge of this triangle. Mark the point, C. The line, OC, is perpendicular to AB.

If the square corner of the triangle is at the point, O, but the edge of the triangle is not along the line, OB, will the line drawn along the other edge of the triangle be perpendicular to AB? Why or why not?

2. Draw a line and mark on it the points, XY. Between these points mark a third point, P, and draw a perpendicular to XY at point, P.

3. To draw a rectangle 4 inches long and 3 inches wide, proceed as follows:

Draw a line, AB, 4 inches long. Place the square corner of the triangle at the point, A, and draw a line. Measure 3 inches on this line and mark point, D. Then move the triangle to the point, B, and draw a line. Measure 3 inches on this line and mark point, C. Connect points, C and D. The figure, $ABCD$, is a rectangle, 4 inches by 3 inches.



Measure the line, CD. If your work is accurate, CD should be 4 inches long.

Draw rectangles having the following dimensions:

4. 3 in. by 2 in.
5. $3\frac{1}{2}$ in. by 2 in.
6. $4\frac{1}{2}$ in. by $3\frac{1}{2}$ in.
7. 5 in. by 2 in.
8. $4\frac{1}{2}$ in. by 3 in.
9. 6 in. by $1\frac{1}{2}$ in.
10. Draw a square 3 inches on a side.

MODEL OF THE 200-INCH TELESCOPE

The picture shows a **model** of the world's largest telescope, located on Mt. Palomar, California. A model is an exact reproduction, greatly reduced in size. Thus, the diameter (distance across) of the lens of the telescope is 200 inches, but the diameter of the lens on the model is only 4 inches. Each part of the model, therefore, is $\frac{4}{200}$ or $\frac{1}{50}$ of the size of the telescope. One of the models of this telescope was made of celluloid at a cost of $2000.

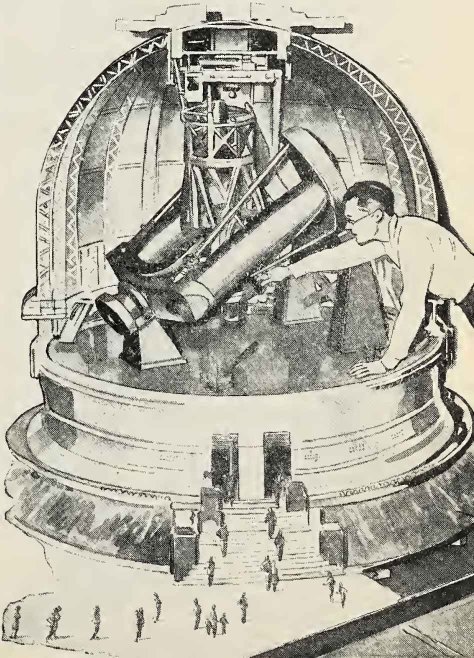
1. A model is $\frac{1}{50}$ real size. What is the length of the object if the length of the model is: *a.* 6 in.? *b.* $4\frac{1}{2}$ in.? *c.* $\frac{3}{4}$ in.? *d.* 1 ft.? *e.* .6 ft.?

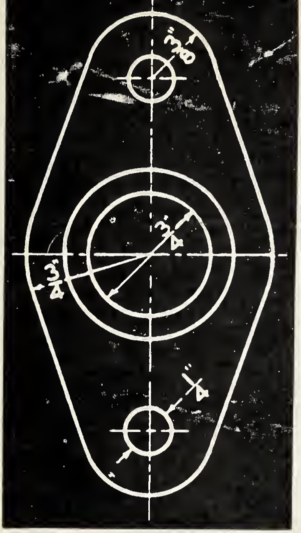
2. A model is $\frac{1}{100}$ real size. What is the length of the model if the length of the object is: *a.* 400 ft.? *b.* 75 in.? *c.* 25 ft.? *d.* 150 ft.?

3. If some parts of the model of the telescope were $\frac{1}{50}$ real size and others $\frac{1}{25}$ real size, would the model be accurate? Explain.

4. In what way is a model superior to a drawing in which each part is shown in reduced scale?

5. What is the advantage of having a model of a structure before actual construction is begun?





The scale of this blueprint is 12″ = 1′ – 0″, that means *full size.*

DRAWING TO SCALE

The model of the Palomar telescope was built to **scale.** Each part of the model was $\frac{1}{50}$ the size of its corresponding part in the telescope. The maps in your geography book are drawn to **scale.** One inch on a map may represent 100 miles of the earth's surface. Every airplane flying to-day began as a series of drawings. Mechanics built each part to exact size simply by following the **scales** marked on their blueprints.

1. A plan of a house is drawn to a scale 1″ = 8′ (1 in. = 8 ft.). What distance is represented in the structure when the distance on the plan is:

a. 2 in.? *b.* $3\frac{1}{2}$ in.? *c.* $1\frac{1}{4}$ in.? *d.* $\frac{1}{2}$ in.? *e.* $4\frac{3}{4}$ in.?

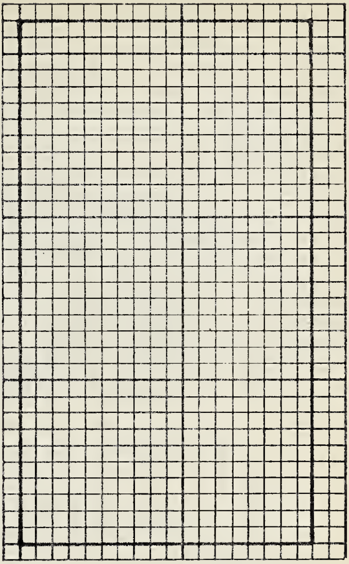
2. A road map is drawn to a scale 1 in. = 10 mi. What is the distance between two places when the distance on the map is:

a. 3 in.? *b.* $4\frac{1}{2}$ in.? *c.* 5 in.? *d.* $2\frac{1}{2}$ in.? *e.* $8\frac{1}{2}$ in.? *f.* 10 in.?

3. Rectangular building lots on a certain street are 50 feet by 125 feet. If a plan of the lots is made to a scale, 1″ = 25′, what will be the dimensions of each lot on the plan?

4. If there are 8 such building lots to a city block, what is the length of the block? How long will be the line on the scale which represents the length of the block?

5. A street is 40 feet wide and 500 feet long. If a plan of the street is drawn to a scale 1″ = 20′, what are the dimensions of the plan?



USING GRAPH PAPER

1. A garden, 32 feet long and 18 feet wide, is shown by scale drawing on graph paper. Each large square on the graph paper is one inch on a side. Each side of the square is divided into tenths. Then, a convenient scale to use is 1″ = 10′.

a. What are the dimensions of the scale drawing of the garden?

b. If each inch on the graph paper were divided into eighths, would you use a scale of 1″ = 10′ or 1″ = 8′? Why?

c. If the scale, 1″ = 8′, were used, what would be the dimensions of the scale drawing of the garden?

2. Use a scale 1″ = 10′, and make scale drawings of the following rectangles:

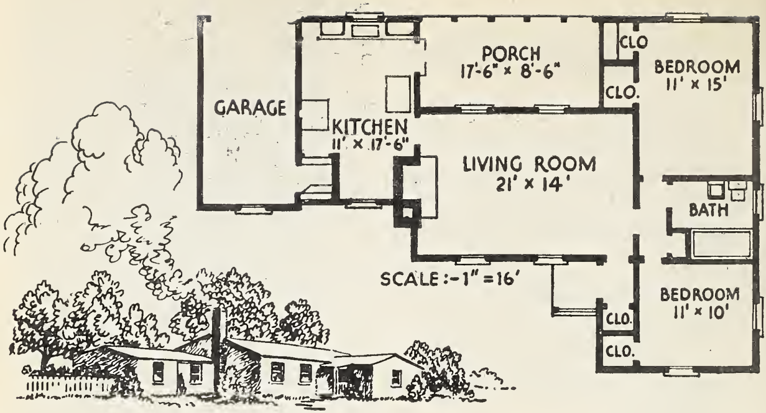
a. 30 ft. by 20 ft. *b.* 54 ft. by 35 ft. *c.* 45 ft. by 28 ft.

3. Use a scale 1″ = 8′, and make scale drawings of the following rectangles:

a. 24 ft. by 16 ft. *b.* 26 ft. by 18 ft. *c.* 6 ft. by 4 ft.

★4. Suppose that each of a series of scale drawings must be placed on a paper 6 inches square. What scale value to the inch would you use if the objects were: *a.* 12 ft. long; *b.* 156 ft.; *c.* 24 mi.; *d.* 346 mi.; *e.* 1040 mi.

★5. A playing field for football is 330 feet by 160 feet. Make a scale drawing of a football field and include the 10-yard markers parallel to the two end lines of the field.


PORCH
17'-6" × 8'-6"
CLO
CLO.
BEDROOM
11' × 15'
GARAGE
KITCHEN
11' × 17'-6"
LIVING ROOM
21' × 14'
BATH
SCALE:-1" =16'
BEDROOM
11' × 10'
CLO.
CLO.

THE FLOOR PLAN OF A BUNGALOW

1. What scale was used in the floor plan of the bungalow?

2. Using this scale, how long should the plan of the living room be? how wide? Check by measurement.

3. The size of the garage is not given. Use the scale to find the actual dimensions.

4. What is the width on the plan from the outside wall of the garage to the outside wall of the larger bedroom? What is the width of the house?

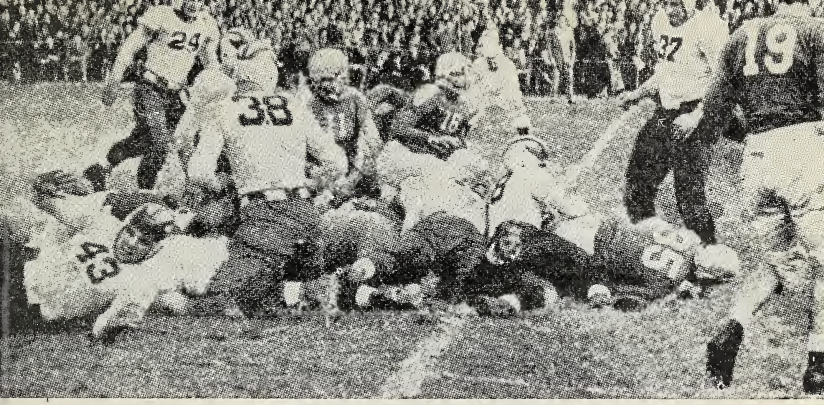
5. How wide are the bedroom closets?

6. Using a scale, 1″ = 8′, find the dimensions of rooms whose dimensions on a floor plan are:

a. 2½ in. by 1¾ in.
b. 4¼ in. by 2½ in.
c. 2¼ in. by 1⅜ in.
d. 3⅛ in. by 1⅞ in.
e. 1½ in. by ⅝ in.
f. 12½ in. by 7½ in.

7. Using a scale, 1″ = 8′, find the dimensions for a scale drawing to represent rooms:

a. 18 ft. by 12 ft.
b. 12 ft. by 9 ft.
c. 14 ft. by 9 ft.
d. 27 ft. by 19 ft.



THE TEAM SCORES

A college football team during 3 seasons of play made the following record:

a.	Yards gained by rushing the ball	5639
b.	Yards gained by forward passes	2129
c.	Number of punts in games	225
d.	Total distance of punts in yards	9165
e.	Yards lost by penalties	1050
f.	Total points scored	753

1. If the football team played 26 games, what was the average number of yards gained in each game by rushing the ball? by forward passes?

2. What was the average distance lost by penalties?

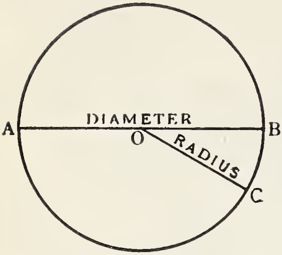
3. What was the average distance of the punts?

4. During three years of college football, one outstanding player punted 224 times for a total of 8367 yards. How much more or less was this for each punt than for the college whose record is shown?

5. What was the total number of yards gained by rushing the ball and by forward passes?

*6. How much more or less than 5 miles was the yardage gained by rushing and passing?

PARTS OF A CIRCLE



Bob told his younger brother, Jim, that archery targets should be 4 feet in **diameter.** Jim did not know the meaning of **diameter.** His dictionary helped with the following definition: "A diameter is a straight line passing through the centre from one side of a circle to another." The dictionary had a drawing on which other parts of the circle were labelled.

The **centre** of the circle is at *O*.

The **diameter,** *AOB*, passes through the centre and connects two points on the circle. What two points does it connect?

A line connecting the centre with a point on the circle is a **radius.** *AO* is a radius. Name another radius.

An **arc** is the part of the circle between two points. *BC* is an arc. Name two other arcs.

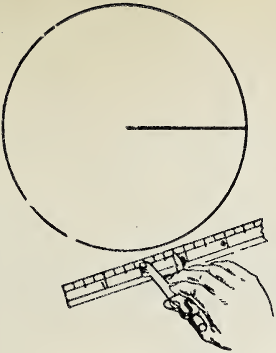
1. A diameter is how many times as much as a radius?

2. A diameter divides a circle into how many equal parts?

LET'S PRACTISE

⑰

	a	*b*	*c*
1.	$8 \times 406 = ?$	$7010 - 2056 = ?$	$9\overline{)3111}$
2.	$4\frac{1}{2} - 2\frac{3}{4} = ?$	$8 \times 5.63 = ?$	$.7\overline{).217}$
3.	$26\overline{)2354}$	$.63 \times .63 = ?$	$27\frac{3}{4} - 17\frac{5}{6} = ?$
4.	10% of $50 = ?$	$7 = ?\%$ of 100	15% of $\$45 = ?$
5.	110% of $275 = ?$	$33\frac{1}{3}\%$ of $18 = ?$	$64 = ?\%$ of 80
6.	$27 = ?\%$ of 81	$125 = ?\%$ of 50	3% of $\$1250 = ?$
7.	$.25\overline{)235}$	$325\overline{)75845}$	$12\frac{1}{4} - 9\frac{3}{8} = ?$



DRAWING CIRCLES

1. Here is a circle with a radius of $\frac{3}{4}$ inch.

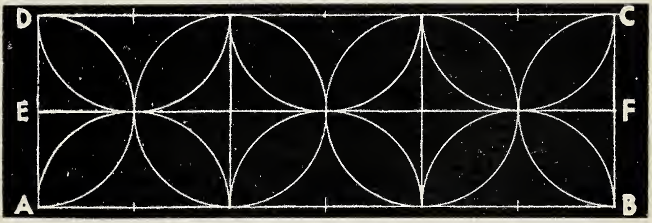
To draw this circle, Joe set one arm of his compasses at an inch division on his ruler. Then he set the other arm of his compasses $\frac{3}{4}$ of an inch from the first. He drew the circle, using a given point for a **centre**. Draw such a circle.

2. Draw a circle which has a radius of: *a*. 2 in.; *b*. $1\frac{1}{2}$ in.; *c*. $2\frac{1}{2}$ in.

3. Draw a circle which has a diameter of: *a*. 3 in.; *b*. $3\frac{1}{2}$ in.; *c*. $4\frac{1}{2}$ in. Check the accuracy of your drawing by measuring the diameter of each circle with your ruler.

*4. Copy this design, using a radius of 1 inch.

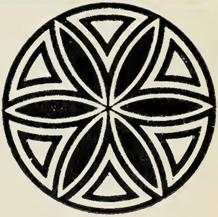
First, draw the rectangle, *ABCD*, having *AD* and *CB* equal to the diameter of the circle. Then draw *EF* parallel to the sides *AB* and *CD*.

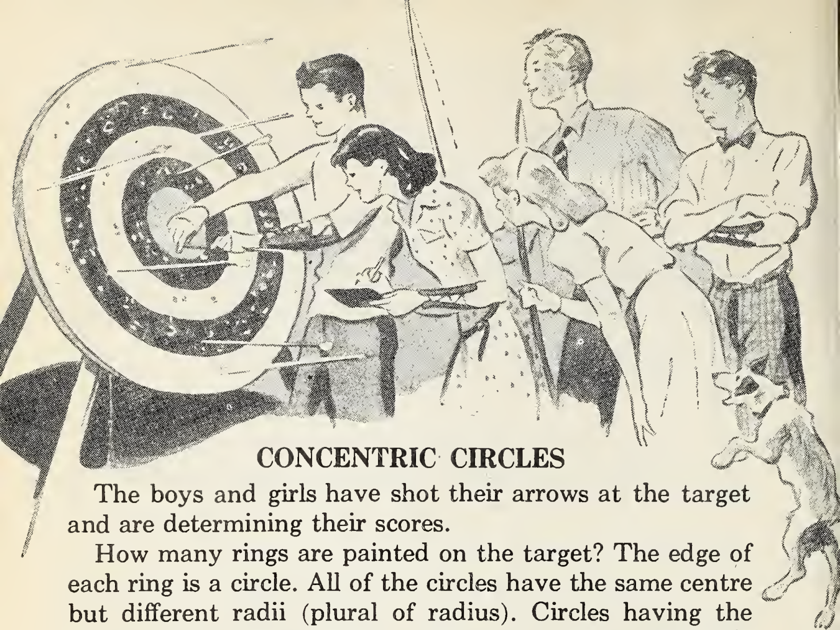


a. What is the length of the rectangle?

b. What is the first point to use for a centre? the last point?

*5. Copy this design. Use any convenient radius for the circle.





CONCENTRIC CIRCLES

The boys and girls have shot their arrows at the target and are determining their scores.

How many rings are painted on the target? The edge of each ring is a circle. All of the circles have the same centre but different radii (plural of radius). Circles having the same centre but different radii are called **concentric circles.**

1. Draw 3 concentric circles with radii of $1''$, $1\frac{1}{2}''$, and $2''$.

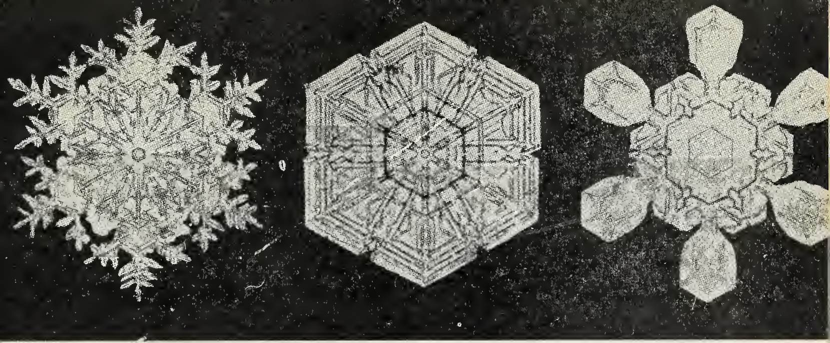
2. Make a drawing showing four concentric circles.

3. In archery, a hit in the centre ring counts 9, in the next ring, 7, in the next, 5, in the next, 3, and in the outer ring, 1. If you shot an arrow into each ring, what would be your total score?

4. A boy shot five arrows for a score of 27. Show three different combinations which give this score.

★5. How do parcel post zones represent concentric circles?

★6. If a stone is thrown into a pool of water, concentric circles are formed. Give at least four other illustrations of concentric circles.



SNOW CRYSTALS

1. How many sides does each snow crystal contain?

2. Each crystal has a centre figure. How many sides does this figure contain?

3. The sides of each snow crystal are of equal length. What name is given to this form of geometric figure?

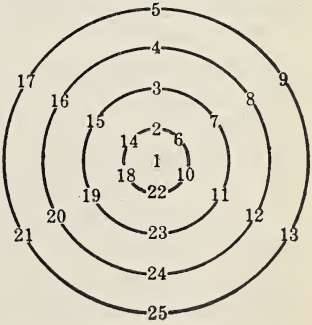
A MAGIC CIRCLE

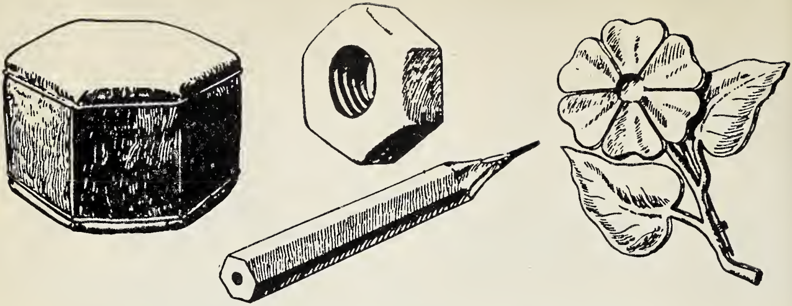
The four concentric circles have the number 1 at the centre, and numbers 2–25 arranged in numerical order on the circles. These numbers form a **magic circle**.

1. What is the sum of the numbers in each of the three rows which cut all of the circles?

2. Are the sums of the numbers along each radius of the largest circle the same or different?

3. If the number 1 at the centre is not included in each of the three rows, will the sums be the same or different?

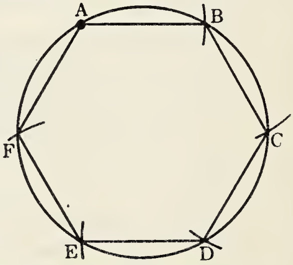




HOW TO DRAW A REGULAR HEXAGON

On this page are drawings of several familiar objects. Name them. How many sides does each have? Geometric figures, having the shape of these objects, are called **hexagons.** If their sides are of equal length, they are **regular hexagons.**

Here is a regular hexagon, *ABCDEF*, inscribed within a circle. Each side of an inscribed hexagon is equal to the radius of the circle.



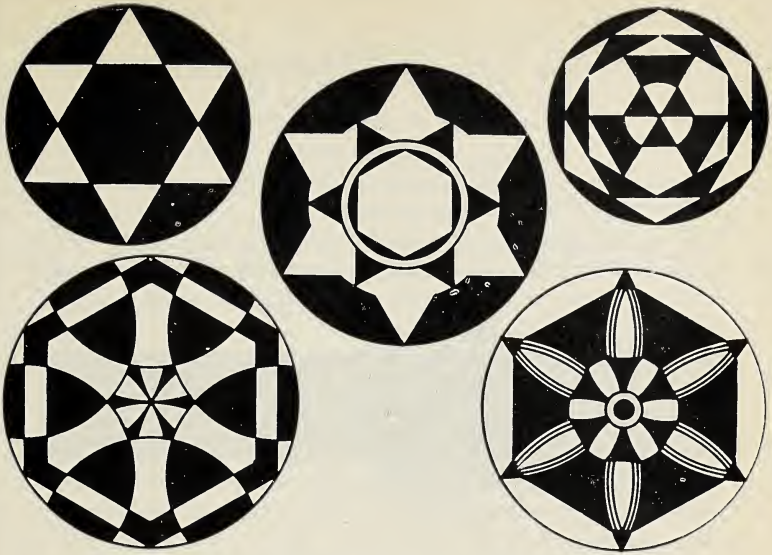
Mark any point, *A*, on the circle. Open compasses to the width of the radius. With *A* as a centre, make an arc which cuts the circle at *B*. With *B* as a centre, make another arc at *C*. In the same way, cut the circle at *D*, *E*, and *F*. Connect the points.

1. Draw a regular hexagon which has a side of 2 inches.

2. If points *A*, *C*, and *E* were connected, what kind of figure would be formed?

3. You found (problem 2) that a triangle was formed. The sides of this triangle are equal; hence, it is called an **equilateral** triangle.

Draw a circle having a radius of $2\frac{1}{2}$ inches. Using the method described, draw an equilateral triangle.



DESIGNS BASED ON A HEXAGON

1. Copy any two or more of the designs, using a 2-inch radius.

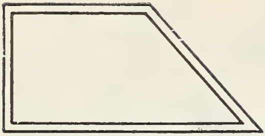
***2.** Make an original design based on a regular inscribed hexagon but differing from those shown.

***3.** Bring to class designs, based on the hexagon, which you may find in newspapers or magazines.

*MAGIC SQUARE

On the right is shown a magic square with some of the cells empty. Draw a square containing 36 cells and complete the square.

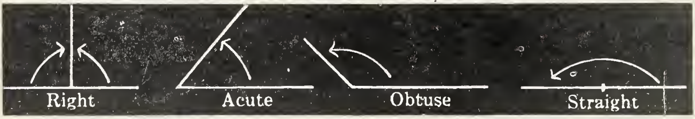
$2\frac{1}{3}$	$\frac{1}{15}$	$\frac{2}{5}$	$1\frac{11}{15}$	$1\frac{4}{15}$	?
$\frac{1}{5}$	$2\frac{2}{15}$	?	?	$1\frac{8}{15}$	$1\frac{2}{3}$
$2\frac{1}{15}$	$\frac{3}{5}$	$\frac{2}{15}$	$1\frac{7}{15}$	?	$1\frac{1}{3}$
$\frac{8}{15}$	?	$2\frac{1}{5}$	$1\frac{2}{15}$	?	1
2	$\frac{1}{3}$	?	$\frac{4}{5}$	$\frac{14}{15}$	$1\frac{1}{15}$
$\frac{4}{15}$	?	$1\frac{14}{15}$	?	$1\frac{1}{5}$	?



KINDS OF ANGLES

A certain make of automobile is equipped with a window similar in shape to the figure shown. Each corner of the figure forms an **angle**

The sides forming the angle are called its **sides.** The point at which the sides meet is the **vertex.** The four most familiar kinds of angles are: **right** angles; **acute** angles; **obtuse** angles; and **straight** angles.



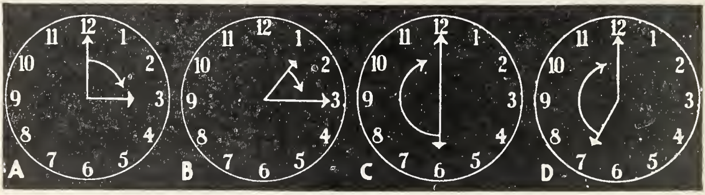
1. A **right angle** is formed by two straight lines perpendicular to each other. Which angles in the car window are right angles?

2. An **acute angle** is less than a right angle. Which of the angles in the window is an acute angle?

3. An **obtuse angle** is greater than one right angle but less than two right angles. Which of the angles in the window is an obtuse angle?

4. When the sides of an angle form a straight line, a **straight angle** is formed. A straight angle, therefore, is equal to two right angles. Draw a straight angle.

5. State what kinds of angles are formed by the hands in the clocks:



HOW TO READ AND TO LETTER ANGLES

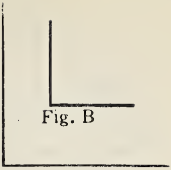


Fig. B

Fig. A

Figures A and B are two right angles. The length of each side (Fig. A) is 1 inch; the length of each side (Fig. B) is .5 of an inch. Thus, you see that **the size of an angle does not depend upon the length of its sides.**

An angle may be lettered in any one of three different ways.

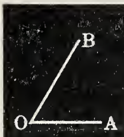


Fig. C

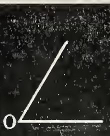


Fig. D

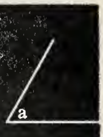


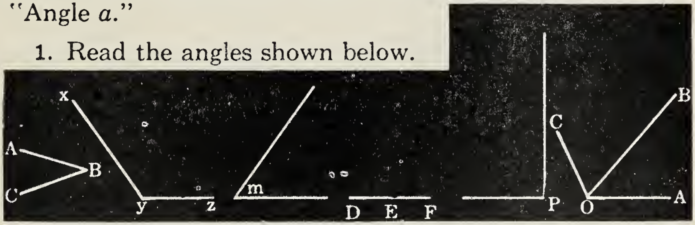
Fig. E

In Figure C, the angle is read, "Angle *AOB*." The vertex letter is always placed between the other two letters.

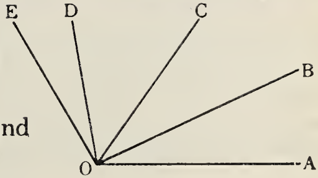
In Figure D, the angle is indicated by a capital letter at the vertex, as *O*. The angle is read, "Angle *O*."

In Figure E, the angle is indicated by a small letter at the vertex between the sides, as *a*. The angle is read, "Angle *a*."

1. Read the angles shown below.



2. What kind of an angle is each angle shown at the right?



3. Draw an acute angle and letter it *M*.

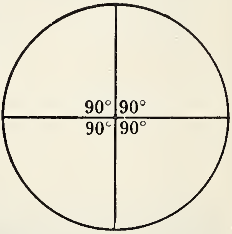
4. Draw an obtuse angle and letter it *ABC*.

HOW ANGLES ARE MEASURED

If you measure a line, you find the number of units of length which it contains, such as inches, feet, yards, or miles. If you measure an angle, you find the amount of rotation, or turning (page 170), of one side from the other. This amount is expressed as **degrees.**

In a circle there are 360 degrees, or 360°. (The symbol ° represents degrees.) Therefore, one degree represents $\frac{1}{360}$ of a circle.

The ancient Babylonians gave the measure for the circle. They thought that the earth made a **complete revolution** about the sun in 360 days; hence, the distance travelled in one day would be $\frac{1}{360}$ of a circle.



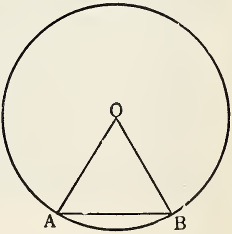
1. This circle shows two diameters perpendicular to each other. What kind of angles are formed? How many degrees are in a right angle? in a straight angle?

2. If an angle contains less than 90°, what kind of angle is it?

3. If an angle is greater than 90°, but less than 180°, what kind of angle is it?

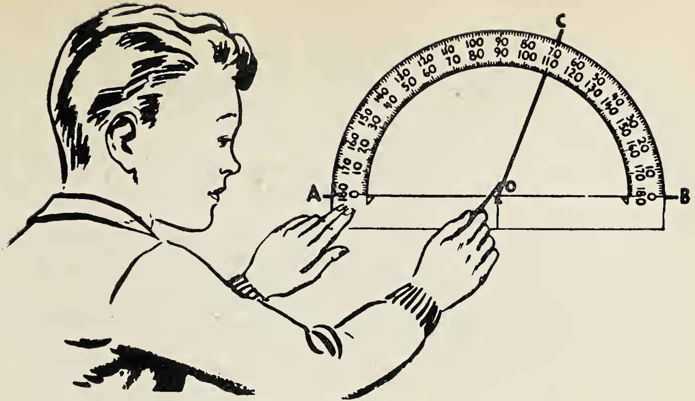
4. How many degrees are in the angle made by the hands of a clock at 9 o'clock?

5. At what other hour of the day (problem **4**) do the hands of a clock make the same angle?



6. *AB* is the side of a regular hexagon. How many degrees are in the angle *AOB*?

***7.** How many degrees would there be in angle *AOB* if *AB* were the side of a regular inscribed figure of 5 sides? of 8 sides? of 10 sides? of 12 sides?



THE PROTRACTOR HELPS WITH ANGLES

An ordinary ruler is used to measure a line, but a foot ruler would not be much help in finding the degrees in an angle. For this purpose you would use a **protractor** or some other instrument designed to measure angles.

Jim is measuring the angle, *BOC*, with his protractor. Note the straight edge of Jim's protractor and the point at the centre of this edge. The half-circle part is the **arc** of the protractor. (An **arc** is any part of a circle.) Into how many degrees is the half-circle arc cut?

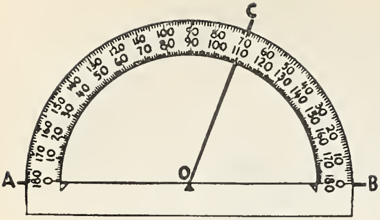
1. Read the inner and outer sets of figures on the arc. Select a pair of these figures. What is their sum? What is the sum of any pair of figures on the arc?

The inner set measures the degrees in an angle reading from left to right; the outer set measures the degrees in an angle reading from right to left.

2. Which degree numbers, from 1–180, show on the protractor? How are the other degree numbers read?

3. Find the mark on the outer set of numbers which represents 35°; 38°; 42°; 90°; 127°; 174°; 180°.

4. Find the mark on the inner set of numbers which represents each of the degrees listed in problem **3**.



HOW TO USE A PROTRACTOR

James wished to construct an angle of 70°.

First, he drew line *AB* as shown, and marked point, *O*, on this line, for the vertex of the angle. He placed the centre of the protractor at point, *O*, and the straight edge along the line, *OB*. Then he read the outer set of numbers on the arc of the protractor from 0° to 70°. At 70° he marked point, *C*, and connected it with point, *O*. The angle, *BOC*, contained 70°.

1. Construct an angle of 70°, beginning at the right of your protractor. Construct another angle of 70°, beginning at the left of your protractor.

2. Construct angles of: *a.* 50°; *b.* 63°; *c.* 128°; *d.* 155°.

3. How many of the angles (problem 2) are acute? obtuse?

4. Construct an angle of 90°. What kind of angle is it?

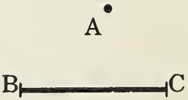
5. Draw a right angle using any square-cornered object. Check the angle with your protractor.

6. Tell how to draw one line perpendicular to another by using a protractor.

7. Using a protractor, construct rectangles having the following dimensions:

a. 3 in. by $2\frac{1}{2}$ in.
b. 2 in. by 2 in.
c. 4 in. by $2\frac{3}{4}$ in.
d. $3\frac{1}{2}$ in. by $2\frac{1}{4}$ in.

★8. Tell how to draw a perpendicular to the line *BC* from point *A*, not on the line.



USING A PROTRACTOR

1. Draw a line 2 inches long. At each end draw an angle of 60°. Extend the lines until they cross. What kind of figure is formed?

2. Measure the third angle in the triangle which you constructed. How many degrees are in this angle?

3. Measure the length of each side of this triangle. Are they all of the same length or of different lengths?

4. What name is given to a triangle the three sides of which are equal in length?

5. A right triangle has one right angle, and only one. Construct a right triangle. Note that it has two acute angles in addition to the right angle. How many degrees in the acute angles? in the right angle? in all three angles?

6. Construct a regular inscribed hexagon (page 168). Find the number of degrees in each vertex. If your measurement is correct, each angle should measure 120°.

7. Connect the centre of the circle (problem **6**) with each end of one of the sides of the hexagon. Measure the degrees in each angle of this triangle. Are these angles equal in size or different? Why?

8. Draw a circle with any convenient radius. Draw a diameter to the circle. With your protractor construct a diameter perpendicular to the other diameter. Connect by straight lines the four points at the ends of the diameters. What kind of figure did you form? Measure each angle to be sure that your work is accurate.

***9.** A triangle, having angles of 30°, 60°, and 90°, is known as a 30–60–90-triangle. Draw a triangle of this kind. Measure the length of each side. Is the triangle equilateral?

HOW TO READ CIRCLE GRAPHS

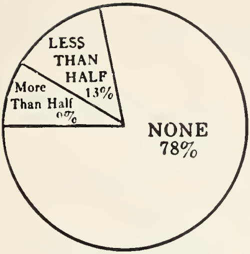


Fig. A.–Part of College Expenses Earned.

Many college students have jobs which pay part of their college expenses. Figure A shows the per cent of such students in one college and their earnings compared to their total expenses.

1. What per cent of the students earned less than half their college expenses? more than half their expenses? none of their expenses?

2. What is the sum of the per cents in problem 1? The whole circle represents what per cent of the students?

3. Find the number of students, to the nearest whole number, in each of the three groups if there were 360 students in the college.

4. This graph shows the different items in the cost of producing pork. Name each item. Which is the largest in per cent? Which is the smallest? How many per cent does the whole circle represent?

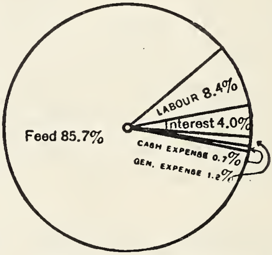


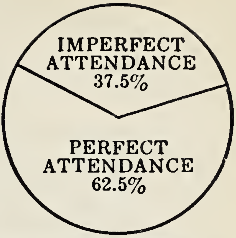
Fig. B.–Cost of Producing Pork.

5. What per cent of the total cost were the expenses, exclusive of those for feed?

6. The total cost of raising some hogs was $2,250. What part of this cost is allowed for the cost of feed? for labour? for interest? for cash expenses?

*7. Which would make the greater difference in the cost of producing pork, a 10% increase in the price of grain, or a 10% increase in the wages of farm labourers?

*HOW TO MAKE A CIRCLE GRAPH



During the month of January, 45 students out of a group of 120 students in the seventh grade of the Brock School had imperfect attendance.

Since 45 students had imperfect attendance, 75 students had perfect attendance. The part of the class having imperfect attendance is $\frac{45}{120}$, or $\frac{3}{8}$, or 37.5%; the part of the class having perfect attendance is $\frac{75}{120}$, or $\frac{5}{8}$, or 62.5%.

$$37.5\% \text{ of } 360° = .375 \times 360° = 135°$$
$$62.5\% \text{ of } 360° = .625 \times 360° = 225°$$

Construct a circle with any convenient radius. At the centre construct an angle of 135° and extend its sides until they cut the circle. Label this part of the graph "imperfect attendance." The remainder of the graph represents all pupils having perfect attendance. Label this part of the graph. Measure the remaining angle to make sure it contains 225°.

John says that he constructs circle graphs as follows:

a. **If the amounts to be graphed are not given as per cents, I find the sum of the numbers.**

b. **I find what per cent each number is of the sum.**

c. **I multiply 360° by each per cent to get the size of each angle at the centre of the graph.**

d. **I draw a circle with any convenient radius.**

e. **At the centre of the circle I construct each angle and extend its sides until they cut the circle.**

f. **I label each part of the graph.**

1. An angle of 225° is how much more or less than a straight angle?

2. If 60 of the 120 students had been absent, how would you show this on a circle graph?

3. If the numbers to be graphed are expressed in per cents, which of John's items may be omitted?

*CONSTRUCTING CIRCLE GRAPHS

Construct circle graphs for each of the following problems:

1. The enrolment of three classes in the Hillside Junior High School is as follows: Seventh grade, 38%; Eighth grade, 34%; Ninth grade, 28%.

If there are 720 students enrolled, find (to the nearest whole number) the number enrolled in each class. Is this sum equal to, more than, or less than 720?

2. Milk produced in this country is used as follows: for fluid milk, 48%; for butter, 25%; for stock feeding, 16%; for other purposes, 11%.

3. For every dollar received from the sale of eggs in this country, the producer receives 59¢, and 41¢ is charged to marketing costs.

4. For every dollar received from dairy products in this country, the producer receives 48¢, and 52¢ is charged to marketing costs.

5. The average retail dollar in this country is spent for the following items: food, 26%; automobiles, 21%; hardware, 7%; clothing, 4%; other things, 42%.

★6. Draw three circles of the same size to represent the following three kinds of soils and their chief contents:

- *a.* clay: sand, 10%; silt, 45%; clay, 45%.
- *b.* clay loam: sand, 34%; clay, 27%, silt, 39%.
- *c.* loam: sand, 32%; clay, 23%; silt, 45%.

★7. In one year 1,730 automobile deaths occurred at night and 620 during daylight hours.

★8. The population of the continents is as follows: Asia, 1,177,000,000; Australia and Africa, 163,000,000; North and South America, 270,000,000; Europe, 529,000,000.

LET'S PRACTISE ⑱

Set I

	a	*b*	*c*
1.	$\$72-\$31.34=?$	$11-4\frac{5}{8}=?$	$7\frac{1}{2}\times 15=?$
2.	$\frac{3}{4}\times 72=?$	$12\times\frac{3}{8}=?$	$9\frac{1}{4}-2\frac{1}{2}=?$
3.	$6\frac{1}{2}\div 2=?$	$1\div\frac{5}{6}=?$	$8\frac{1}{2}\div 4\frac{1}{4}=?$
4.	$.7\times .54=?$	$15\div .5=?$	$.912\div 1.6=?$
5.	$87\div 10=?$	$31.45\div 1000=?$	15% of $72=?$
6.	125% of $40=?$	2% of $780=?$	$18=?\ \%$ of 24
7.	$10=?\ \%$ of 5	$5=?\ \%$ of 4	$64=?\ \%$ of 32

Set II

1.	$4\div\frac{5}{6}=?$	$6\times 1.8=?$	$96\times 1.5=?$
2.	$100\times 9.2=?$	$5\frac{1}{6}-4\frac{3}{4}=?$	$56.4\div 100=?$
3.	$6\frac{1}{2}\div 2=?$	$\$50.12-\$18.43=?$	$.305-.296=?$
4.	$1-\frac{5}{9}=?$	$6819\div 187=?$	$\frac{7}{8}\div 1\frac{1}{7}=?$
5.	30% of $65=?$	200% of $48=?$	24% of $780=?$
6.	$40=?\ \%$ of 60	$60=?\ \%$ of 40	$1=?\ \%$ of 50

7. $\$64.87+\$97.18+\$9.34+\$70.39+\$24.36=?$

Set III

1. Find, to the nearest hundredth, the decimal value of: *a.* $\frac{3}{8}$; *b.* $\frac{1}{3}$; *c.* $\frac{1}{6}$; *d.* $\frac{2}{3}$; *e.* $\frac{5}{9}$; *f.* $\frac{4}{7}$; *g.* $\frac{1}{16}$.

2. Express as per cents: *a.* .12; *b.* $\frac{1}{2}$; *c.* .3; *d.* $\frac{4}{5}$; *e.* 1.02; *f.* .025; *g.* 3; *h.* $\frac{2}{3}$; *i.* 1.5.

3. Express the following per cents as decimals or whole numbers: *a.* 20%; *b.* 125%; *c.* 200%; *d.* 101%; *e.* 3%; *f.* 37.5%; *g.* 1%; *h.* 2.5%; *i.* 110%.

4. If $\frac{2}{3}$ of a number is 24, what is the number?

5. If $\frac{3}{4}$ of a number is 36, what is the number?

6. What is 20% more than 48?

7. What is 20% less than 48?

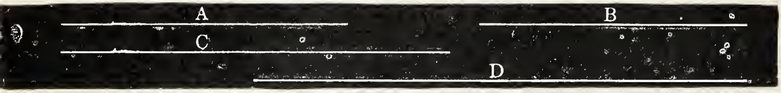
DIVIDING A LINE

Roads in many parts of Canada are divided into two traffic lanes by a stripe down the centre. Men of the Provincial Highway Departments **measure** the width of hard surface of a road and use half this width as a guide in painting the stripe. That is, they divide the line representing the distance across at any point by **measurement**; not the most exact method, as you will learn (page 181)

1. How do such traffic stripes help to promote highway safety?

2. Can the position of a white line on a highway be determined with sufficient accuracy by measurement? Explain.

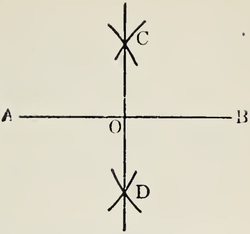
3. Use a ruler to measure the length of each of these four lines What is the length of half of each line?



4. Use a ruler to measure the length of the longest line of type on this page. What is half this length?

5. Measure the length and height of the sheet of paper on which this arithmetic lesson is printed. What are half the dimensions?

BISECTING A LINE



A more accurate way than by **measurement** to divide a line in half is by **construction** with ruler and compasses. A line so divided is said to be **bisected.**

To bisect the line *AB*:

From *A* as a centre and the opening of the compasses greater than half *AB*, draw an arc on each side of *AB*. From *B* as a centre and the same opening of the compasses, draw other arcs cutting the first at *C* and *D*. Connect these points.

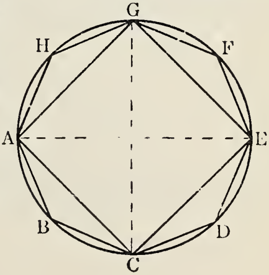
Line *CD* is the **bisector** of *AB*. It is also the **perpendicular bisector** of *AB*. Why?

1. Why must the opening of the compasses be greater than half *AB* to fix the points *C* and *D*?

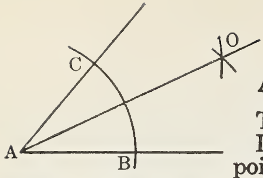
2. If the opening of the compasses was half *AB*, what point would be located on *AB*?

3. Draw a circle of any convenient radius. Rule a diameter of the circle and bisect it, at right angles, with another diameter. Connect the ends of these diameters. What kind of figure did you inscribe?

4. Bisect each side of the inscribed square (problem 3). Continue the perpendicular bisector until it cuts the circle. At how many points (including the inscribed square) is the circle cut? Connect these points. You have constructed an **octagon** inscribed in a circle. *ACEG* is an inscribed square; *ABCDEFGH* is an inscribed octagon.



5. Construct an inscribed square 2 inches in diameter; an inscribed octagon 2 inches in diameter.



BISECTING AN ANGLE

An angle may also be bisected.

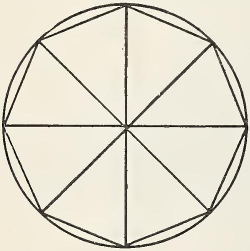
To construct an angle and to bisect it: Let *A* be any given angle. Set the sharp point of the compasses at *A*. With any convenient radius draw an arc cutting the sides of the angle at *B* and *C*.

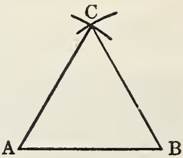
From *B* as a centre and a radius greater than half *BC* draw an arc. From *C* as a centre and the same radius draw an arc cutting the other at *O*. Draw *AO*. It bisects Angle *A*.

1. Draw an angle of 50° and bisect it. With your protractor measure the parts of the angle and see if they are equal.

2. Draw an angle of 120° and bisect it. Check the accuracy of your construction with your protractor.

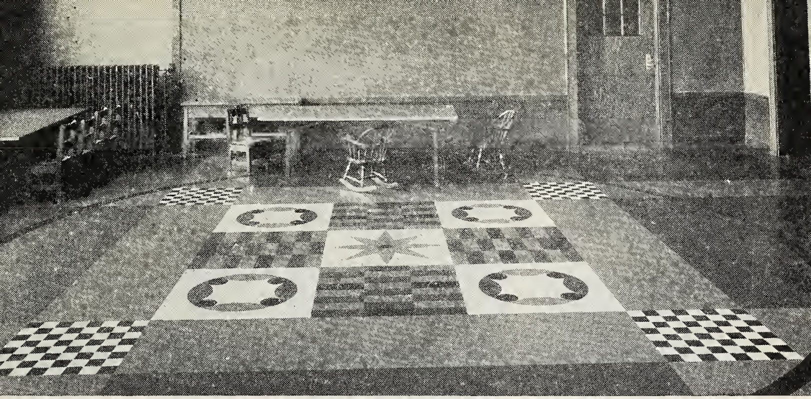
3. Draw a circle with a radius of 2 inches. Draw a diameter to the circle and bisect it at right angles with another diameter. Bisect two of the right angles on the same side of the diameter and continue the lines to cut the circle. Connect the points on the circle. If your construction is accurate, the inscribed figure is a regular octagon.





4. What kind of triangle is shown? Tell how this triangle was constructed. Construct an equilateral triangle by the method shown.

*5. Construct a regular octagon. Then arrange the numbers 1–9 so that the sum of the numbers along each diameter will be the same. (HINT: Put 5 at the centre.)



GEOMETRY IN FLOOR PATTERNS

The picture shows a kindergarten room.

1. Name each geometric figure in the linoleum covering the floor; on the wall facing you.

2. How many points has the star in the middle of the floor?

*TOPICS FOR SPECIAL REPORTS

1. What is a sextant and how is it used?

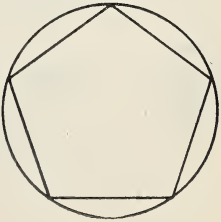
2. What is a transit and how is it used?

3. What is Gothic architecture? Find illustrations of it in your community.

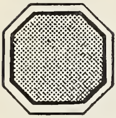
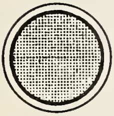
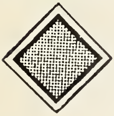
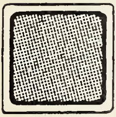
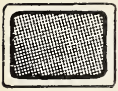
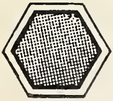
4. What is Corinthian architecture? Find illustrations of it in your community. How does Corinthian architecture differ from Gothic architecture?

5. Show how you would lay out a baseball diamond with a protractor and a measuring tape.

6. Show how to construct a regular pentagon (five sides).



THE GEOMETRY OF HIGHWAY SIGNS

SIGN	MEANING	REASON
OCTAGON 	"STOP"	Dangerous corner—through traffic—stop street—trunk line junction, and so on.
ROUND 	"STOP"	Railroad crossing. One horizontal bar means one track, two horizontal bars mean two tracks, and so on.
DIAMOND 	"SLOW"	Curve—turn—hill—narrow bridge—loose gravel—pavement ends—begin detour—soft shoulders, and so on.
SQUARE 	"INFORMATION"	School zone—cross road—playground—men working—church zone—side road—hospital zone, and so on.
RECTANGLE 	"DIRECTIONS"	Keep to right—no left turn—no parking—speed limit 20 miles—one hour parking, and so on.
HEXAGON 	"SLOW"	Dead end street—obstruction on road, and so on.

Highway signs have different shapes, and each shape signals its warning (in a general way) to the driver.

Be sure to note the shape of each sign, learn what it means, and the reasons for the sign.

1. What is the shape of the "stop-street" sign?

2. What shape indicates a sharp curve just ahead? that the road ends?

3. How many of the signs give warning or danger signals to the driver? What are their shapes?

★4. Check the highway signs in your neighbourhood to see if their shapes correspond with those shown on this page.

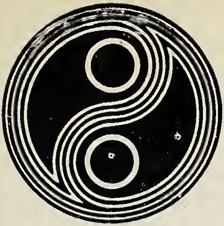


Fig. A

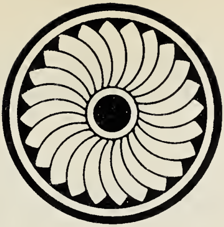


Fig. B

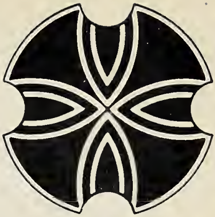


Fig. C

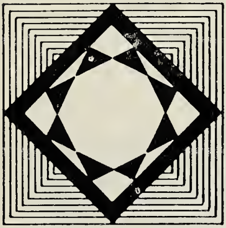


Fig. D

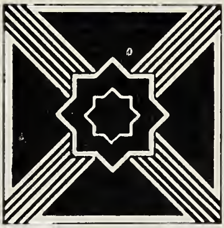


Fig. E

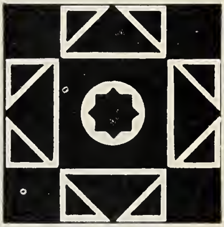


Fig. F

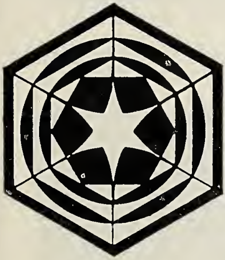


Fig. G

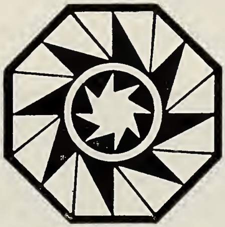


Fig. H

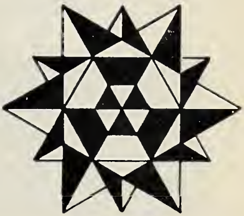


Fig I

*COPYING DESIGNS

On this page are various geometric designs based on regular geometric figures. Construct at least three of these designs.

Figures A, B, and C are based on the circle.

Figures D, E, and F are based on the square.

Figures G, H, and I are based on the hexagon or the octagon.

HOW WELL DO YOU REMEMBER?

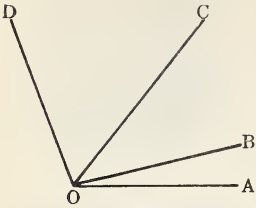


FIG. A

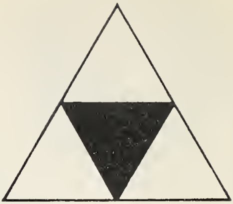


FIG. B

1. Draw an acute angle; an obtuse angle. With your protractor measure the number of degrees in each angle.

2. Construct a line perpendicular to another line.

3. Draw a rectangle which is 4 inches by 3 inches.

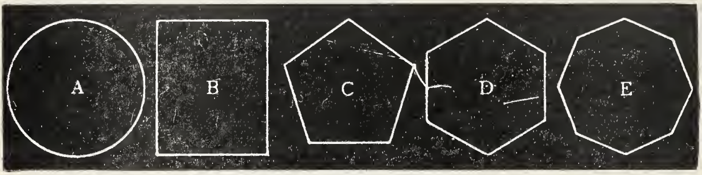
4. A map is drawn to a scale 1 in. = 500 ft. Find the distance between two places $4\frac{3}{4}$ inches apart on the map.

5. If a map is drawn to a scale 1 in. = 25 mi., two cities, 120 miles distant from each other, are how far apart on the map?

6. Draw three concentric circles using a radius of 2 inches for the largest circle.

7. Draw a regular hexagon which has a side of $1\frac{1}{2}$ inches.

8. Give the name of each figure.



9. Read five different angles in Figure A at the top of the page. Read four acute angles; one obtuse angle.

10. Draw an angle of 140° and bisect it.

11. A certain electric light company spends its income as follows: labour 35%; supplies, 20%; taxes, 22%; other items, 23%. Show these amounts by a circle graph.

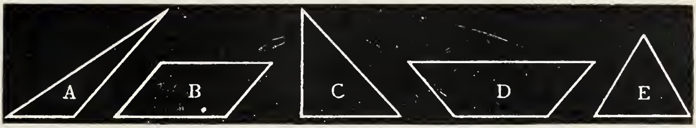
12. Construct the design shown in Figure B. How many different equilateral triangles are formed?

THINGS TO REMEMBER

1. *How to read, draw, and bisect an angle.*
2. *How to bisect a line.*
3. *What is meant by scale drawing.*
4. *How to read and to construct a circle graph.*
5. *The shapes of different regular geometric figures.*

TEST ON CHAPTER VI

1. State what kinds of angles are formed in the following figures. Which figures contain parallel lines?



2. Draw a square 2 inches on a side. Bisect one of the angles. If your construction is correct, the bisector should also bisect the opposite angle.

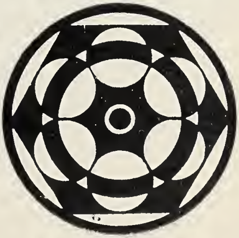
3. At the centre of a circle draw a 60° angle having radii for two of its sides. Join the two points where the radii cut the circle. If your work is correct, this line should be the same length as the radius.

4. A blueprint is drawn to a scale 1 in. = 8 ft. What length on the object is represented by a line $2\frac{5}{8}$ inches long on the blueprint?

5. The Smith family's income was spent for: food and shelter, 50%; clothes and recreation, 20%; other things, 30%. Show the amounts by a circle graph.

6. Copy this design based on the circle and the hexagon.

7. Draw a figure of four sides to contain two right angles, an acute angle, an obtuse angle, and two parallel sides.



PROGRESS TEST

If you make errors on this test, turn to the pages keyed in parentheses where the work is explained.

1. $19342 \div 28 = ?$ (22)
2. $61325 - 18436 = ?$ (11)
3. $406 \times 907 = ?$ (15)
4. $7\frac{1}{2} \times 4\frac{1}{3} = ?$ (48)
5. $23.40 - 9.56 = ?$ (67)
6. $.78 \times 3.06 = ?$ (70)
7. $126.24 \div 2.63 = ?$ (86)
8. $6\frac{7}{8} \div \frac{3}{4} = ?$ (54)
9. 35% of 48 = ? (130)
10. 20 = ? % of 60 (136)

11. Express as decimals: *a.* $\frac{3}{4}$; *b.* $\frac{1}{8}$; *c.* $\frac{4}{5}$; *d.* $\frac{4}{25}$; *e.* $\frac{5}{8}$; *f.* $\frac{3}{20}$; *g.* $\frac{9}{16}$. (76)

12. Express as per cents: *a.* .4; *b.* 3; *c.* 1.02; (123)
d. .875; *e.* $\frac{1}{2}$; *f.* $\frac{3}{4}$; *g.* 1.6. (126)

13. Round off the following numbers to the nearest thousand: *a.* 4395; *b.* 5500; *c.* 9643; *d.* 27499. (29)

14. Find the sum of 9 lb. 4 oz. and 7 lb. 14 oz. (9)

15. From 8 ft. 3 in. subtract 3 ft. 9 in. (11)

16. Arrange the following fractions in order of size, beginning with the smallest: $\frac{3}{4}$, $\frac{5}{6}$, $\frac{5}{8}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{8}$, $\frac{11}{12}$. (68)

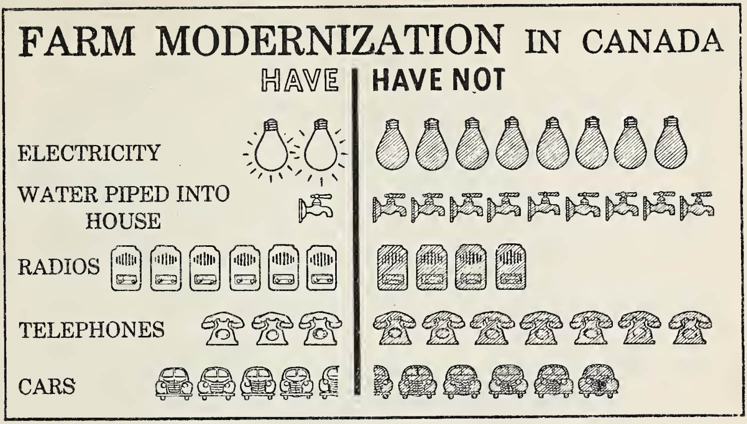
17. When the cost of a dozen eggs increases from 36¢ to 45¢, what is the per cent increase? (141)

18. When the cost of a pound of sugar increases from 6¢ to 7¢, what is the per cent increase? (141)

19. There are 252 telephone calls on the average made yearly by each person in Canada. If the population of the country is 11,500,000, how many telephone calls are made in a year? (15)

20. There are about 1,700,000 telephones in operation in this country. If our population is 11, 500,000, what is the ratio of the number of telephones to the number of people? (50)

TO A NEW CHAPTER



CHAPTER VII

CANADA'S HOUSING PROBLEM

1. From its title what would you say the picture graph shows?

2. To what country does the graph apply?

3. What symbol is used for each household convenience?

4. Each symbol represents what per cent of all farms in Canada?

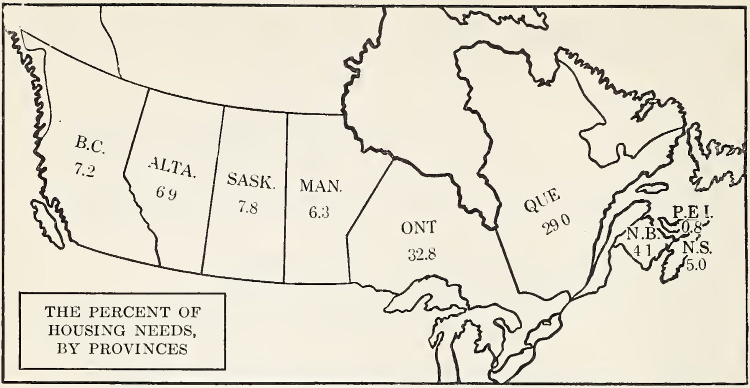
5. What per cent of the farms is equipped with electricity? with water? with radios? with telephones? with automobiles?

6. Of the conveniences shown, which is used on the smallest per cent of farms? on the largest per cent of farms?

7. There are about how many times as many farm homes equipped with radios as with electric lights?

*8. Before the number of farms can be determined, what additional facts must be included on the graph?

*9. How do these farm conveniences affect the standard of living of the farmers?


B.C.
7.2
ALTA.
6.9
SASK.
7.8
MAN.
6.3
ONT
32.8
QUE
29.0
N.B.
4.1
P.E.I.
0.8
N.S.
5.0
THE PERCENT OF HOUSING NEEDS, BY PROVINCES

HOUSING NEEDS OF OUR COUNTRY

1. Anna clipped the following headline from her local paper: "180,000 New Housing Units Needed." Accompanying the news item was this map. What do the percentages on the map show?

2. Find the sum of the per cents of all the provinces.

3. In which province is the number of housing units required the greatest? the least?

4. In which province is the number needed eight times as great as in another province? nine times as great as in another province?

5. Find the number of new housing units needed in each province.

6. If the average cost of each new housing unit is $3750, find the cost, to the nearest million, of building 180,000 new units.

★7. A government housing bureau report stated, "One third of our people are poorly housed." How can you determine if a family is or is not properly housed?

A STANDARD FOR HOUSING

The National Housing Act (N.H.A.) provides loans for people who are building new homes. These loans can be secured from **approved lending institutions,** such as insurance companies. The borrower agrees to repay a certain amount each month and to build the house according to N.H.A. standards, some of which are listed below.

Standard 1. The house shall not cover more than 33% of the lot on which it stands.

If the lot is 3960 square feet, how many square feet may the house cover?

Standard 2. In any habitable room, the total window area shall be not less than 10% of the floor area.

If the floor area of a living room is 160 square feet, what is the least window space permitted?

Standard 3. Size of standard (single purpose) rooms:

Type	Minimum Floor Area	Minimum Width
Living Room	150 sq. ft.	10 ft.
Dining Room	80 sq. ft.	8 ft.
Kitchen	50 sq. ft.	5 ft.
First Bedroom	110 sq. ft.	9 ft.
Additional Bedroom	80 sq. ft.	7 ft.

What is the minimum floor space of a N.H.A. house with a living room, dining room, kitchen, and 3 bedrooms?

Standard 4. Minimum ceiling heights: principal habitable rooms except bedrooms 8 feet; bedrooms and other habitable rooms 7½ feet.

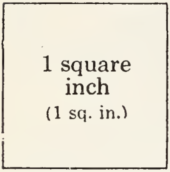
NOTE: In bedrooms with sloping roofs, minimum height shall be 7½ feet for not less than one-half of the floor space.

How much clearance has a man 6 feet tall in a kitchen?

*5. Check your house against N.H.A. standards.

THE MEANING OF AREA

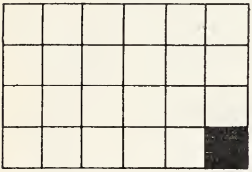
On page 191 the minimum N.H.A. standard for any given room in a house was expressed in terms of floor **area.** As rooms are usually rectangular in shape, you should know how to find the area of a rectangle.



The area of any surface is the number of square units which it contains. The unit may be a square having a side of one inch, one foot, one yard, or any other measure of length. A measure of length is called a **linear** (line) **measure.** The square at the left is 1 inch on a side. What is its area?

1. The rectangle below is 6 units long and 4 units wide. How many squares are in each row? how many rows?

2. How many squares are in the rectangle?



3. If the shaded square represents 1 square inch, how many square inches are in the rectangle?

4. What would be the area of the rectangle if the shaded square represented one square foot? one square yard? one square mile?

LET'S PRACTISE

⑲

	a	*b*	*c*
1.	.6 × 3.8 = ?	9.1 × .025 = ?	3.78 ÷ 27 = ?
2.	.972 − .885 = ?	100 × .038 = ?	77.76 ÷ 21.6 = ?
3.	54 ÷ 3.6 = ?	.35 × 4.8 = ?	.6 + .4 + 1.9 = ?
4	18% of 45 = ?	210% of 450 = ?	2.5% of 360 = ?
5.	20 = ? % of 60	75 = ? % of 50	36 = ? % of 180

6. Express as decimals or whole numbers: *a.* 6%; *b.* 20%; *c.* 22%; *d.* 1%; *e.* 500%; *f.* 125%; *g.* 4%; *h.* 103%.

WHY WE USE A SQUARE FOR MEASURING AREA

Dorothy could not understand why the area of a rectangle is expressed in square units. "Why not in circles?" said she. So she tried to find the area of the rectangle by drawing circles within the rectangle.

1. How many circles did she draw?

2. If the area of each circle is 1 unit, is the area of the rectangle 20 units? more than 20? less than 20? Why?

3. Draw a rectangle 3 inches long and 2 inches wide. Try to fit circles in this rectangle so that they occupy all the space and do not overlap.

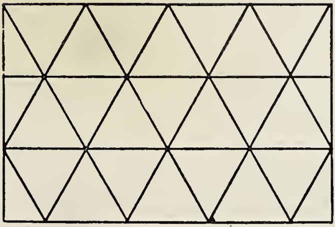
4. Hilda tried to fill the space in a rectangle with equilateral triangles of the same size. How many triangles was she able to crowd into the rectangle?

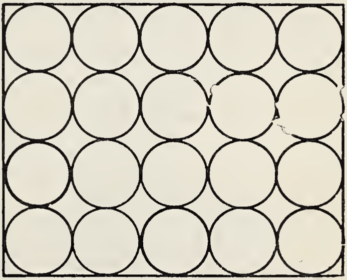
5. If the area of each triangle is 1 unit, is the area of the rectangle 21 units? more than 21? less than 21? Explain.

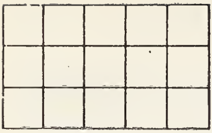
6. Draw a rectangle 3″ × 2″ and try to fill all of the space with equilateral triangles 1 inch on a side.

7. Draw a rectangle of the same size (problem 6) and prove that all the space can be filled with 1-inch squares.

Your experiments should convince you that **a square is the most practical unit for measuring area.**







FORMULA FOR THE AREA OF A RECTANGLE

The rectangle is 5 linear units long and 3 linear units wide. Therefore, its area is 15 square units.

The number of square units in the area of a rectangle is equal to the product of the number of linear units in its length and width. This rule may be shortened to:

The area of a rectangle is equal to the product of the length and width.

The **formula** for the area of a rectangle is $A = l \times w$

A formula is a very short way to express a **rule**.

Rule: **Area equals length times width.**

Formula: $A \quad = \quad l \quad \times \quad w$

The formula, $A = l \times w$, may be further shortened to $A = lw$.

In your study of **algebra,** you will find that letters are used for numbers, and the multiplication sign (used with numbers) is omitted when letters represent the numbers; hence, lw means $l \times w$.

1. In the formula $A = lw$, state what each letter represents.

2. Find the area of a rectangle 8 inches long and 5 inches wide.

$l = 8$ in. $\qquad A = lw$

$w = 5$ in. $\qquad A = 8 \times 5$

$A = 40$

The area is 40 square inches.

3. What is the area if $l = 8$ ft. and $w = 5$ ft.?

4. What is the area of the rectangle at the top of this page?

FINDING AREAS OF RECTANGLES

Find the areas of rectangles whose dimensions are:

	a		*b*	
	LENGTH	WIDTH	LENGTH	WIDTH
1.	14 in.	12 in.	9 ft.	5 ft.
2.	$6\frac{1}{4}$ in.	$3\frac{1}{2}$ in.	$14\frac{1}{2}$ ft.	$9\frac{3}{4}$ ft.
3.	7.5 ft.	5 ft.	8.6 yd.	4.5 yd.
4.	26.2 in.	14.8 in.	0.75 in.	0.65 in.
5.	18.5 ft.	12.9 ft.	3.1 mi.	1.7 mi.

6. A house 30 feet long and 25 feet wide is built on a lot 75′ x 40′. Could the owner get a N.H.A. loan on this property (page 191, Standard 1)? Explain.

7. Tell whether or not each of the following houses conforms to Standard 1, page 191.

DIMENSIONS OF HOUSE	DIMENSIONS OF RECTANGULAR LOT
a. 32 ft. by 24 ft.	100 ft. by 40 ft.
b. 36 ft. by 28 ft.	75 ft. by 35 ft.
c. 34 ft. by 28 ft.	75 ft. by 40 ft.
d. 28 ft. by 24 ft.	60 ft. by 45 ft.

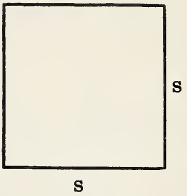
8. A single dwelling on a corner may cover 40% of the area of its lot (N. H. A. standards). If a bungalow, 48′ × 36′, occupies a corner lot, 100′ × 60′, would the owner be entitled to a N. H. A. loan? About what per cent of the lot is occupied by the house?

9. Which of the following living rooms meet N. H. A. Standards? (See page 191, Standard 3).

a. 14 ft. by 11 ft.
b. 12 ft. by 12 ft.
c. $14\frac{1}{2}$ ft. by $12\frac{1}{2}$ ft.
d. 18 ft. by 9 ft.
e. 21 ft. by 12 ft.
f. $16\frac{3}{4}$ ft. by $10\frac{1}{4}$ ft.

10. At least how many square feet of window space must each room, rated **Standard** (problem 9) have?

FINDING THE AREA OF A SQUARE



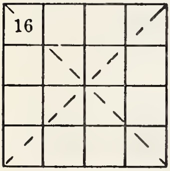
Here are 4 statements which you should recognize as old acquaintances:

a. A square is a rectangle which has equal sides.
b. All squares are rectangles.
c. All rectangles are not squares.
d. The formula for the area of a rectangle is $A = lw$.

In a square, $l = w$. The formula, therefore, becomes $A = l \times l$ or $A = w \times w$.

Usually, the side of a square is represented by s. Then the formula for the area is $A = s \times s$, or s^2.

The small ^{2} written above the letter s is called an **exponent.** It shows that s is to be multiplied by itself. s^2 is read, "s-square." It means $s \times s$. Thus, if $s = 4$, $A = 4 \times 4$, or 16.



Find the area of squares whose sides are:

1. 3 in.
2. 4.5 ft.
3. 5 ft.
4. 6.4 ft.
5. 7 yd.
6. $10\frac{1}{2}$ yd.
7. $3\frac{1}{2}$ in.
8. 8.7 ft.

*HOW TO MAKE A MAGIC SQUARE

Begin at 16 and count backward, one number for each cell. Write the number which corresponds to the cell if the cell is cut by a diagonal. The first number 16 is written in the first cell in the upper left corner. The number of the next cell, counting backward, is 15. But this cell is not cut by a diagonal so this number is not written in the second cell. Continue from left to right in each row until the last cell in the lower right corner contains 1.

Beginning at the upper left corner, count forward from 1 to 16 and write the correct number in each cell which is not filled. The first number to be written is 2 in the second cell from the left in the upper row. (Courtesy of Royal Vale Heath)

A TABLE FOR AREA

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
272¼ square feet or 30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
43,560 square feet = 1 acre

1. On ruled paper, measure a square 12 units on a side. How many small squares are in the large square? How does your experiment prove that there are 144 square inches in a square foot?

2. Prove there are 9 square feet in a square yard.

3. If there are 16½ feet in a rod, prove that there are 272¼ square feet in a square rod.

4. If there are 5½ yards in a rod, prove that there are 30¼ square yards in a square rod.

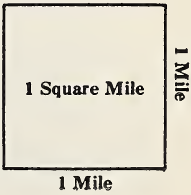
5. If there are 16½ feet in a rod, prove that there are 5½ yards in a rod.

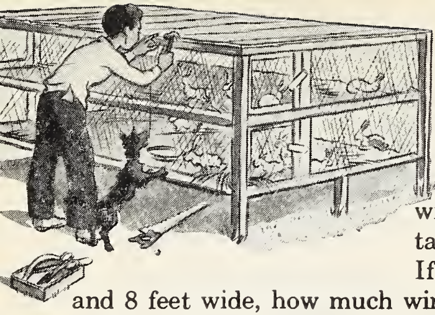
6. Should a living room contain more or less than a square rod to meet N. H. A. standards (page 191)?

7. There are 272¼ square feet in a square rod and 160 square rods in an acre. Prove that there are 43,560 square feet in an acre.

8. If a strip of land is a mile square, its area is 1 square mile. Explain.

9. A square mile contains 640 acres, or a **section.** Farm A covers ½ section. How many acres are in it? Farm B covers ¼ section. How many acres are in it?





THE PERIMETER OF A RECTANGLE

Tony wanted to buy enough wire fencing to enclose a rectangular pen for his rabbits. If the pen was 12 feet long and 8 feet wide, how much wire fencing was needed?

The amount of fencing needed was the same as the distance around the rectangular pen. The distance around a figure, as you recall, is its **perimeter.**

The formula for the perimeter of a rectangle is

$$p = l + w + l + w \text{ or } p = 2l + 2w$$

1. What does each letter represent in the formula?

2. Using the formula, $p = 2l + 2w$, find the amount of wire fencing needed to enclose the pen.

$l = 12$
$w = 8$

$$p = 2l + 2w$$
$$p = 2 \times 12 + 2 \times 8$$
$$p = 24 + 16, \text{ or } 40$$

Tony needed 40 feet of wire to enclose the pen.

3. Find the perimeter of rectangles whose dimensions are:

	Length	Width		Length	Width
a.	4 ft.	3 ft.	*e.*	18 ft.	14 ft.
b.	21 ft.	15 ft.	*f.*	25 in.	18 in.
c.	$9\frac{1}{2}$ ft.	$6\frac{1}{2}$ ft.	*g.*	$12\frac{1}{4}$ ft.	$8\frac{1}{2}$ ft.
d.	14.8 ft.	9.5 ft.	*h.*	10.8 in.	6.9 in.

4. The formula for the perimeter of a square is $p = 4s$. If the side of a square is 6 inches, what is its perimeter?

LET'S PRACTISE

20

Set I

	a	b	c
1.	$56\overline{)2744}$	$.9 \times .75 = ?$	$27 \div \frac{3}{4} = ?$
2.	$9\frac{1}{4} - 8\frac{7}{8} = ?$	$28\overline{)2166}$	$.08 \times 7.5 = ?$
3.	$1.16\overline{)39.44}$	$\frac{5}{8} \div 6 = ?$	$14\frac{3}{4} - 7\frac{5}{6} = ?$
4.	6% of 480 = ?	$2\frac{1}{2}$% of 500 = ?	300% of 92 = ?
5.	1 = ? % of 100	100 = ? % of 150	24 = ? % of 12
6.	100% of 94.5 = ?	102% of 450 = ?	17 = ? % of 50

Set II

1.	$4003 - 3009 = ?$	$9\frac{1}{4} \times 2\frac{2}{3} = ?$	$268\overline{)81472}$
2.	$5\frac{3}{4} \div 1\frac{1}{2} = ?$	$.35 \times .35 = ?$	$\frac{8}{9} \div \frac{5}{6} = ?$
3.	$1.7 \times 2.8 = ?$	$75 \div .6 = ?$	$24\frac{1}{3} - 15\frac{7}{8} = ?$
4.	90 = ? % of 75	120% of 68 = ?	50 = ? % of 150

5. $\$96.78 + \$34.57 + \$7.65 + \$43.16 + \$25.50 = ?$

6. $4\frac{5}{6} + 2\frac{1}{2} + 8\frac{3}{4} + 7\frac{2}{3} + 12\frac{1}{4} = ?$

Set III

1. If $\frac{3}{4}$ of a ton of coal cost $8.10, find the cost a ton.

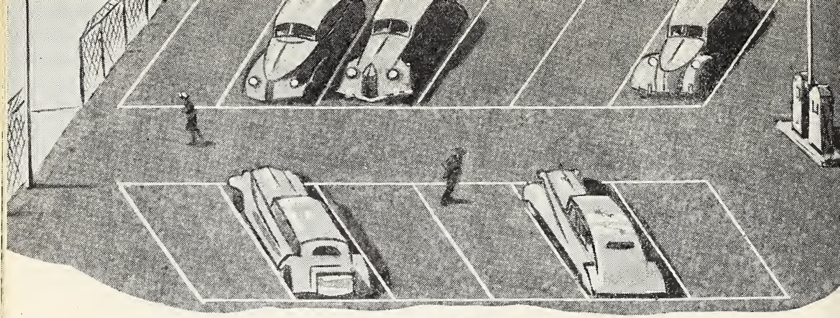
2. A train travelled 45 miles in $\frac{5}{6}$ of an hour. At that rate, find the distance travelled in an hour.

3. Draw an angle of 72° and bisect it. Measure the accuracy of your construction with a protractor.

4. If an obtuse angle is bisected, what kind of an angle is each half?

5. In a recent year $1\frac{1}{2}$% of first-class mail in this country went by air mail. What per cent was sent by other means?

★6. In a certain college, 16% of the students earned less than half of their expenses; 18% more than half; 66% earned nothing. Show these data by a circle graph.



PARALLELOGRAMS

The lot above is marked for parking. The space reserved for each car is a **parallelogram**; that is, **a four-sided figure having its opposite sides equal and parallel.**

1. If a parallelogram has all right angles, what kind of figure is it?

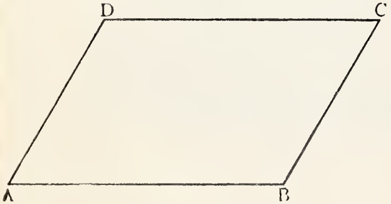
2. Are all parallelograms rectangles? Are all rectangles parallelograms? Why or why not?

3. Is a square a parallelogram? Why or why not?

4. May a parallelogram have equal sides and not be a square? If so, draw such a figure.

The figure, $ABCD$, is a parallelogram. To construct $ABCD$: Draw a line, as AB. At A, draw any acute angle, as 50°. At B, draw an angle equal to $180° - A$, or $180° - 50° = 130°$. Measure equal lengths on the sides of these angles as $AD = BC$. Connect the points C and D. The figure formed is a parallelogram.

5. Construct a parallelogram in which the longer sides are 3 inches and the shorter sides, 2 inches.



*6. Find illustrations of parallelograms which are not rectangles about your school, your home, your community.

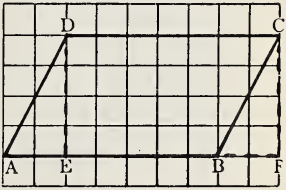
THE AREA OF A PARALLELOGRAM

Ralph and Garry had an argument about the shape of the parking space (page 200). Ralph said, "Parallelograms are used for parking spaces instead of rectangles because a parallelogram contains more space than a rectangle of the same length and width."

Garry said, "The two figures contain the same area." Garry made a drawing to prove that his statement was correct.

1. What kind of figure is *ABCD*? *EFCD*? Have they the same length and width, or different?

2. Construct a parallelogram and label it *ABCD*. Cut off the triangle *AED* along *DE*. Place this triangle so that it falls on *BCF*. What does this prove about the areas of a parallelogram and a rectangle having the same base and height?



The length of each figure (*AB* or *EF*) is its **base**. The height, or width, is the **altitude**. Altitude is always measured perpendicular to the base.

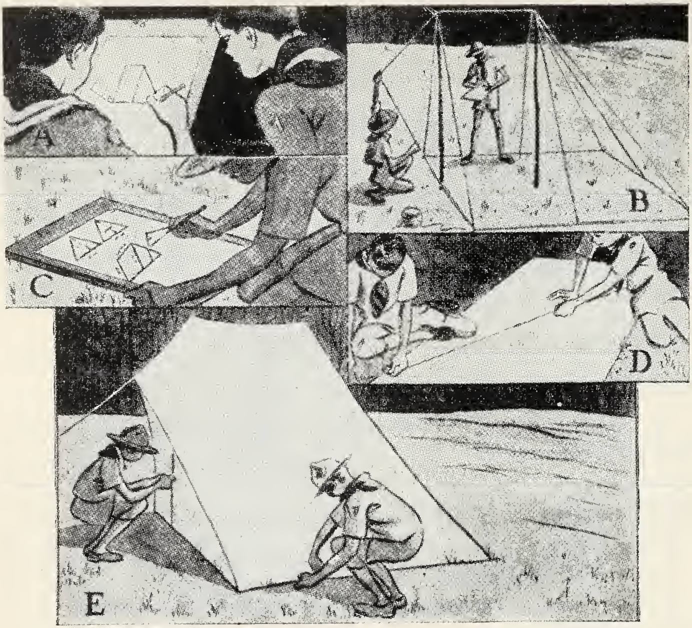
RULE: **The area of a parallelogram is equal to the product of its length (base) and its width or altitude.**

FORMULA: $A = ba$.

3. What does each letter represent in the formula?

Find the area of parallelograms whose dimensions are:

BASE	ALTITUDE	BASE	ALTITUDE	BASE	ALTITUDE
4. 16 in.	9 in.	6. $7\frac{3}{4}$ ft.	$5\frac{1}{2}$ ft.	8. 22 in.	$14\frac{1}{4}$ in.
5. 14 yd.	$6\frac{1}{4}$ yd.	7. 9 ft.	$5\frac{1}{2}$ ft.	9. 28 in.	$18\frac{1}{2}$ in.



DESIGNING A TENT

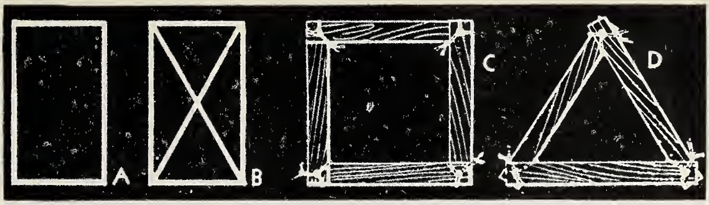
Jack and Bob, two boy scouts, designed and erected the tent which you see pictured on this page.

Bob's drawings (Fig. A and C) contain several kinds of geometric forms. How many triangles do you find in the sketches? What other figures is Bob also using?

1. How many triangles do you count in the string model of the tent? What other figure do you see in the model?

2. Figure C is Bob's scale drawing of the tent. Why did the scouts need both a scale drawing and a model of the tent?

The big question for you to keep in mind is: Why did Jack and Bob use so many triangles in the design and construction of their tent?



IS A RECTANGLE RIGID?

Figure A is the frame from the chassis of an automobile.

1. The salesman for the car said: "That is the most **rigid** (stiff, firm, unbending) frame used in any automobile." Would his statement be true to-day? Explain.

2. Now look at the frame pictured in Figure B. How many triangles does it contain? Is it more or less rigid than Figure A? Why?

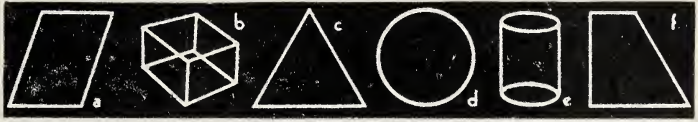
3. Cut four strips of wood, bore a hole in each end, and fasten the ends as in Figure C. Then cut three strips and fasten them as in Figure D. Which figure is more rigid?

This should prove to you that a triangle is much more rigid than any figure of 4 or more sides.

PLANE AND SOLID FIGURES

If a figure has only length and width, it is a **plane figure**; if it has length, width, and depth or thickness, it is a **solid figure.**

1. State which figures are plane figures and which are solid figures.



2. Is the top of a flat desk a plane or a solid? Is the board of which the top of the desk is made a plane or a solid?

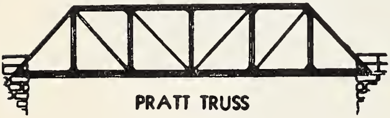
TRUSS BRIDGES

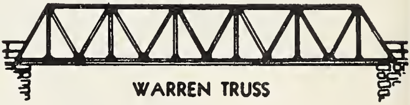
A triangle, as you have proved, is rigid; hence it is used in the construction of bridges. If the length of the bridge span is too great for unsupported beams or girders, a **truss bridge** may be constructed. The bridges shown below are truss bridges. Note that the framework of each bridge is put together in the form of triangles. The triangle is the only plane figure whose shape cannot be changed without changing the length of its sides.

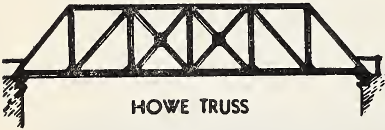
1. Find illustrations of triangles in each bridge design.

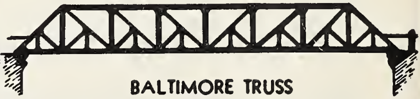
2. What other kinds of figures which you have studied are you also able to identify in the bridge designs?

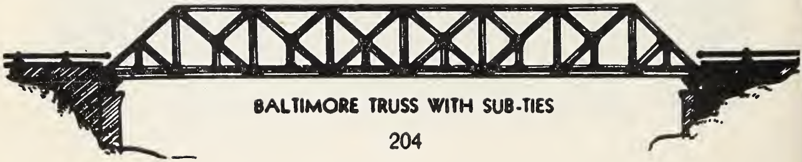
*3. Find illustrations of triangles used in the construction of buildings or bridges in your community, especially where very heavy loads must be supported.


PRATT TRUSS

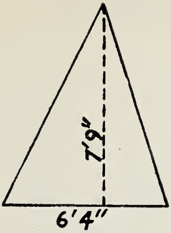

WARREN TRUSS


HOWE TRUSS


BALTIMORE TRUSS


BALTIMORE TRUSS WITH SUB-TIES

FORMULA FOR THE AREA OF A TRIANGLE



When Bob was designing the tent (page 202) he had to find the area of the triangular pieces so that he could order the correct amount of canvas. The dimensions of one of the triangular pieces are as shown.

1. How does the area of the triangle ABC compare with the area of the parallelogram $ABDC$?

2. Cut from paper two equal triangles and place them as in Figure B. What kind of figure is formed? What is the area of this figure?

3. How does the area of each triangle compare with the area of the parallelogram (Fig. B)?

From this work you get the following statement, rule, and formula:

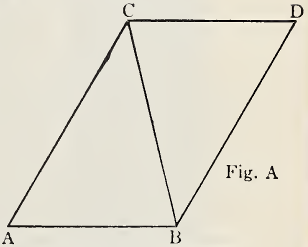


Fig. A

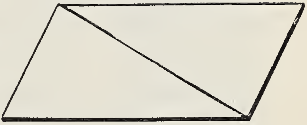


Fig. B

STATEMENT: The area of a triangle is equal to half the area of a parallelogram of the same base and altitude.

RULE: **The area of a triangle is equal to half the product of its base and the altitude.** FORMULA: $A = \frac{1}{2}ba$.

4. What does each letter in the formula represent?

5. Find the area of a triangle having a base of 8 inches and an altitude of 6 inches.

$A = \frac{1}{2}ba$	$A = \frac{1}{2} \times 8 \times 6 = 24$
$b = 8$ in.	
$a = 6$ in.	The area is 24 square inches.

FINDING THE AREA OF A TRIANGLE

Find the areas of the following triangles:

	BASE	ALTITUDE		BASE	ALTITUDE
1.	14 in.	9 in.	**7.**	$12\frac{1}{2}$ ft.	7 ft.
2.	5 ft.	12 ft.	**8.**	$9\frac{1}{2}$ in.	$6\frac{1}{2}$ in.
3.	32 in.	27 in.	**9.**	$3\frac{1}{2}$ ft.	$1\frac{3}{4}$ ft.
4.	6 yd.	2 yd.	**10.**	6.4 ft.	8.5 ft.
5.	3 mi.	1 mi.	**11.**	.8 in.	.6 in.
6.	26 in.	17 in.	**12.**	1.6 mi.	2.5 mi.

***13.** Find the area of the triangular piece of canvas whose dimensions are given on page 205.

***14.** The base of a triangle is 14 inches and its altitude is 9 inches. What will be the area of a parallelogram which has the same base and altitude?

***15.** Draw a rectangle 4 inches long and 3 inches wide. Draw a diagonal of the rectangle. What kind of triangles are formed?

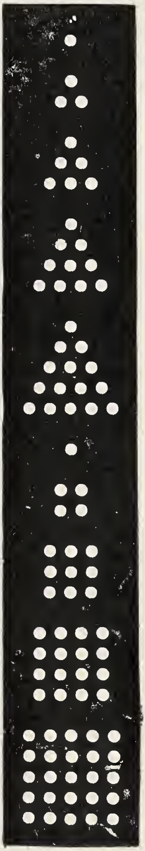
***16.** Measure the length of the diagonal in problem **15.** If your measurement is correct, the length of the diagonal is 5 inches. A right triangle of this kind is often known as a **3-4-5 right triangle.** What does this mean? What is the ratio of each side to each of the other sides?

LET'S PRACTISE

	a	*b*	*c*
1.	$1\frac{1}{3} - \frac{5}{6} = ?$	$\frac{7}{8} \times 36 = ?$	$48 \div \frac{3}{4} = ?$
2.	$9\frac{1}{4} \times 4\frac{1}{2} = ?$	$4.75 - 2.38 = ?$	$36 \div .4 = ?$
3.	$21.6 \div .36 = ?$	$108 \times 564 = ?$	$912 \div .16 = ?$
4.	$3000 - 58 = ?$	$7239 \div 156 = ?$	16% of 750 = ?
5.	2.5% of 140 = ?	36 = ? % of 108	54 = ? % of 27
6.	$2\frac{1}{4} + 5\frac{7}{8} + 7\frac{1}{2} + 3\frac{1}{8} + 6\frac{3}{4} = ?$		

*SQUARE AND TRIANGULAR NUMBERS

The ancient Greeks were interested in representing numbers by dots arranged in the shapes of triangles, squares, pentagons, hexagons, and the like.



Write the numbers 1, 2, 3, 4, 5.
Consider the first number, 1.
Then add the first two numbers, 1 + 2 = 3.
Next add the first three numbers, 1 + 2 + 3 = 6.
In the same way add the next number to the previous group.
The sums of the five groups of numbers are 1, 3, 6, 10, and 15.
These numbers may be represented by dots arranged to form triangles.

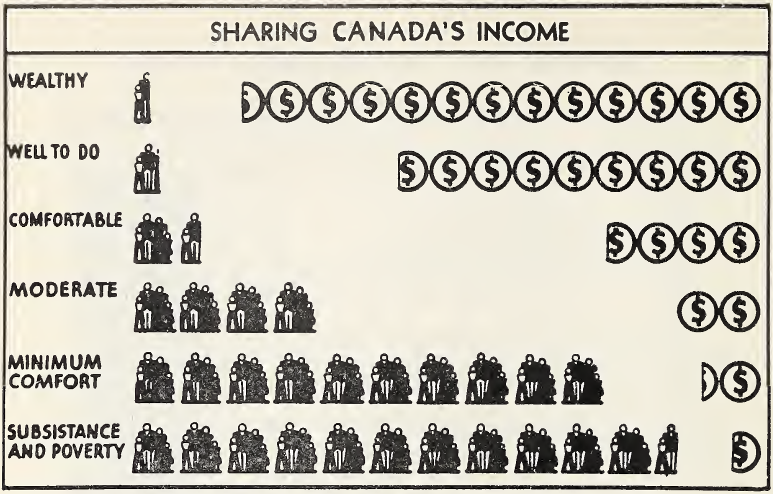
1. The numbers, 3, 6, 10, 15, were called **triangular numbers.** Why?

2. By the use of dots write triangular numbers having a base of 6; of 8; of 9.

The numbers 1, 3, 5, 7, 9, are odd numbers. If the sums of these numbers are found as in triangular numbers, **square numbers** may be formed.

Consider the first number, 1.
Then add the first two odd numbers, 1 + 3 = 4.
Next add the first three odd numbers, 1 + 3 + 5 = 9.
In the same way add the next odd number to the previous group. The sums of these numbers for the five groups of numbers given are 1, 4, 9, 16, and 25. These numbers may be written by dots as shown.

3. Show as a square number the sum of the first 6 odd numbers; the first 7.



*OUR FAMILY INCOMES

The average Canadian family consists of four persons. The average yearly income of these families is shown by the graph. Each group (4 persons) represents 100,000 families; each circle represents $2000 yearly income.

1. About how many families are represented on the graph?

2. What income group has the largest number of families? About what is the average income for this group?

3. What income group has the fewest families? About what is the average income for this group?

4. A government report on 100 families showed that 27 had less than $750 income a year. What per cent of the total number of families had less than $750 income?

5. About what is the total income of all the families shown on the graph?

6. About what is the average income of a Canadian family, according to this graph (HINT: total income ÷ total families)?

HOW INCOME AFFECTS HOUSING

1. Mary wanted to know whether the graph, "How Canada's Families Share Canada's Income" (page 208) included items other than salary or wages. What do you think? Would you include the share of crops received by a farm hand? the dwelling provided for a minister? What other sources of income could you name?

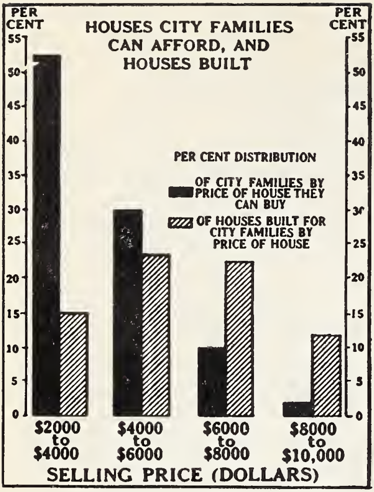
2. A family may spend up to but should not spend more than 20% of its income for housing. On this basis, find the largest amount which a family in each income group (page 208) should set aside yearly for housing expenses.

3. If a house is purchased on a N. H. A. (page 191) loan, the owner generally has 20 years in which to pay. The amount due each month varies with the size of the loan; a $3,000 loan, for example, costs $17.27 monthly. Would you recommend that a family having a yearly income of $1200 take out a $3000 loan? Why or why not?

4. A $4000 N. H. A. loan, costs the purchaser $22.69 a month. Would you advise a family with a yearly income of $1200 to take out such a loan? Why or why not?

*5. Find out from a local contractor the approximate cost of building a five-room bungalow (kitchen, living room, dining room and 2 bedrooms) according to minimum N. H. A. standards.

*6. After Victor had studied the income levels of different families, he formed the following conclusion: "A very large percentage of the families in this country will be poorly housed until their incomes are increased." Tell whether or not you agree with Victor and why.



HOUSES THAT CITY FAMILIES CAN AFFORD

After Verna had studied the income of families in this country and how income affects housing, she noticed this graph in her local paper and clipped it for her arithmetic class.

1. Is this a horizontal or a vertical bar graph? Why?

2. What do the black bars show? the shaded bars?

3. About what per cent of the families included in the graph can afford to own a house costing from $2000 to $4000? About what per cent of the houses built are in this price range?

4. In which price range is the difference least between any pair of bars on the graph?

5. About what per cent of families can afford a house costing from $8000 to $10,000? About what per cent of the houses built are in this price range?

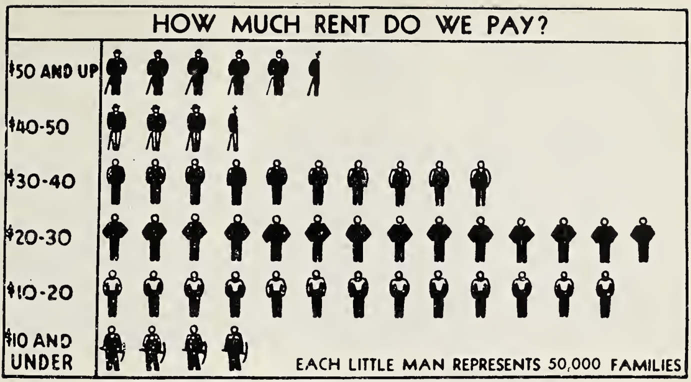
★6. From the graph, decide which of the following statements are true and which are false:

a. More families can afford to own a house which sells for $5000 or less than for more than this amount.

b. People have a tendency to buy houses which are too expensive for their incomes.

c. The smaller the income, the greater per cent of it must be spent for housing.

d. There are only half as many houses built to sell for $6000 to $8000 as should be built.



WHAT FAMILIES SPEND FOR RENT

After the arithmetic class had been studying income and home ownership for a time, its attention was directed by the above graph to the problem of renting a home.

1. Each manikin (model or figure of a person) on the graph represents how many families?

2. About how many manikins are shown on the graph? They represent about how many families in this country?

3. Does your answer (problem 2) include all families in this country? Why or why not?

4. Which rental group includes the greatest number of families? If the average monthly rent a family in this group is $25, what is its yearly rent?

5. Which rental group includes the smallest number of families? If the average monthly rent a family in this group is $45, what is its yearly rent?

6. Each manikin on the graph represents what per cent of the total number of manikins?

7. Find the per cent of the total number of families in each rental group.

8. About what per cent of the non-farm families in this country spend more than $40 a month for rent?

BETTER WAYS OF LIVING

In his civics class James learned of the government housing developments which are replacing **slum** districts in so many of our large cities. His dictionary gave **slum** as "a crowded dirty part of a city where people of low income live." "Should the government build better homes for these people?" asked James. Then he solved the following problems. What was his answer?

1. The cost of fire protection for each person in a slum area was $8.27; in other parts of the same city, $2.74. The cost in the slum area was about how many times as great as for the district outside?

2. The cost of tuberculosis care for each person in a slum area was $3.04; outside this area, $1.17. How many times the outside cost was the slum cost? Explain this difference.

3. The total government cost for each person in a slum area was $11.50; outside this area, $4.20. The cost in the slum area was about how many times as great as for the district outside?

4. The table below shows the total cost of government in slum districts of 3 cities and the amount of taxes collected for these areas:

	Cost of Maintaining Slums	Total Income to City from Slums	Loss to City
City A	$1,357,000	$225,035	?
City B	310,800	44,800	?
City C	153,370	17,070	?

Find the loss to each city for maintaining the slum districts.

★5. The amount collected by each city from its slum district was about what per cent of the cost of this district?

★6. Money for operating a city government comes from taxes. The amount of tax depends upon the value of property. Why do slum districts pay but a small part of the cost of city government?

★7. State why you think crime will be much greater in slum areas than outside.

LET'S PRACTISE

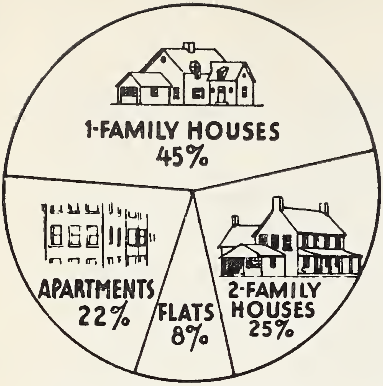
	a	*b*	*c*
1.	$8 \times 96 = ?$	$.400 - .328 = ?$	$6.295 - 5.798 = ?$
2.	$4.368 \div .78 = ?$	$.76 \times .508 = ?$	$5\frac{1}{4} - 4\frac{7}{8} = ?$
3.	$7.24 \div .01 = ?$	$.01 \times 3.14 = ?$	$\frac{1}{2} \times 4\frac{2}{3} \times 2\frac{5}{6} = ?$
4.	38% of 95 = ?	103% of 680 = ?	2.5% of 320 = ?
5.	84 = ? % of 42	36 = ? % of 60	25 = ? % of 125

6. Round off the following decimals to the nearest hundredth: *a.* .425; *b.* 1.499; *c.* .095; *d.* .996; *e.* .4449; *f.* 3.501.

7. Express the following as per cents: *a.* $\frac{1}{2}$; *b.* .6; *c.* $\frac{2}{3}$; *d.* .03; *e.* $\frac{1}{4}$; *f.* 2; *g.* 1.2; *h.* $\frac{3}{4}$; *i.* 1.25.

8. Express the following per cents as decimals or whole numbers: *a.* 12%; *b.* 4%; *c.* 4.5%; *d.* 146%; *e.* 500%; *f.* 110%; *g.* 100%; *h.* 102%; *i.* 37.5%.

9. What per cent of 36 is 54?



KINDS OF DWELLINGS IN A CITY

In one Canadian city all dwellings were classified as **one-family, two-family, flats,** and **apartments.** A **flat,** according to this grouping, contained three to five families; an **apartment,** six or more families. The number of families living in each kind of dwelling was counted and this circle graph was constructed.

1. About what per cent of the families live in either one- or two-family houses?

2. If there were 47,000 housing units in the city, find the number of units for each kind of house shown in the graph.

3. A study of the kinds of material used in the construction of the houses in this city showed: wood, 78%; brick, 14%; stucco, 6%; other materials, 2%. Picture these percentages by means of a circle graph.

4. Some of the dwellings were vacant:

One-family....	2.4%	Flats.... .. .	1.9%
Two-family...	1.5%	Apartments...	4.5%

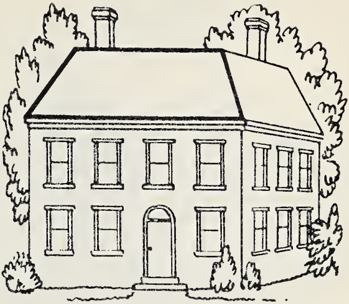
How many dwelling units were vacant in each class?

5. About one third of the flats were store properties—stores on the first floor, living quarters above. How many flats were over stores?

6. Of the store properties, 6.4% were vacant. How many were vacant?

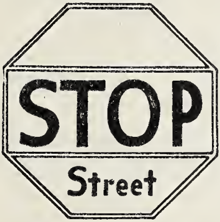
*7. What are some of the advantages of living in an apartment compared to a one-family dwelling? What are some of the disadvantages?

THE TRAPEZOID



In the roof of the house, find a geometric figure of 4 sides, 2 of which are parallel. Such figures are **trapezoids.** A trapezoid, therefore, is a four-sided figure which has only two sides parallel.

The face of a "stop-street" sign is shown.



1. How many sides does a stop-street sign have? What name is given to a figure of this kind?

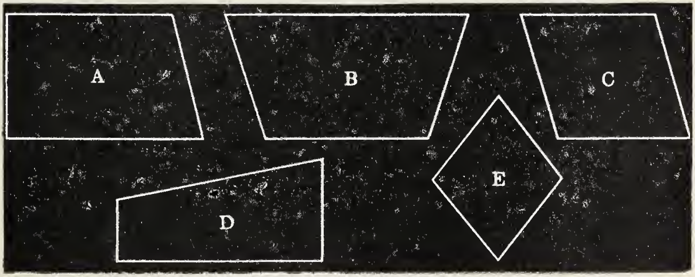
2. Find two trapezoids on this sign.

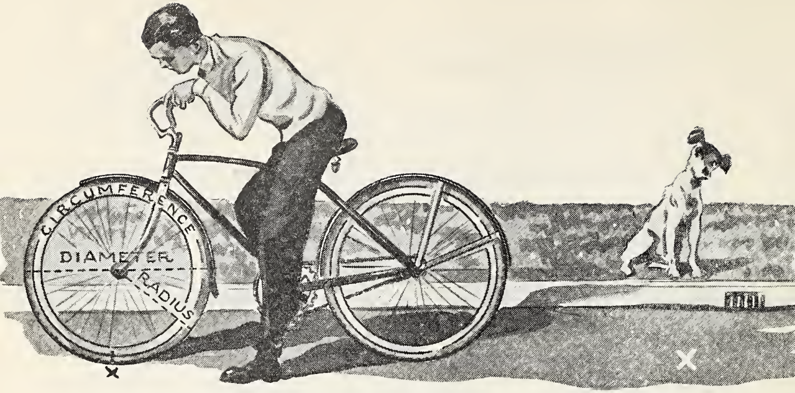
3. What other kind of geometric figure appears on the face of a stop-street sign?

4. Which of the figures below are trapezoids?

5. Cut from paper a triangle. Hold the scissors parallel to the base and cut off part of the triangle. What kind of figure is each part?

6. Draw a trapezoid. Now extend the two sides which are not parallel, until they meet. What kind of figure is formed?





THE CIRCUMFERENCE OF A CIRCLE

The distance around a wheel or a circle is its **circumference.**

Henry wanted to know how far his bicycle travelled when one of the wheels made a complete turn or revolution. He marked with chalk the spot on the pavement which the wheel touched and the corresponding spot on the tire. Then he moved the wheel until the spot on the tire again touched the street. He marked the pavement at this point. The distance between the two marks on the pavement is the circumference of the bicycle wheel. Henry found this to be 88 inches.

1. If you have a bicycle, measure the circumference of a wheel by Henry's method.

2. Henry measured the diameter of the wheel of his bicycle and found it to be 28 inches. The circumference is how many times the diameter?

3. Measure the circumference and the diameter of a tin can. Then divide the circumference by the diameter. Compare with problem 2. What do you find?

FORMULA FOR THE CIRCUMFERENCE OF A CIRCLE

If your measurements (problems **2–3**, page 216) were correct, you found that the circumferences of the 2 circles were about $3\frac{1}{7}$ times their diameters.

If the circumference of any circle is divided by its diameter, the quotient will always be the same. The exact value of this quotient can never be found, but approximately it is $3\frac{1}{7}$, or 3.14. The quotient of the circumference of any circle divided by its diameter is represented by the Greek letter π; spelled **pi,** and pronounced **pie.**

The formula for the circumference is

$$C = 3\tfrac{1}{7} \times d, \text{ or } C = \pi d.$$

1. State what each letter represents in the formula.

2. Since $d = 2r$, the formula for the circumference may also be written

$$C = 2 \times \pi \times r, \text{ or } C = 2\pi r.$$

What does r represent in the formula?

3. Find the circumference of a circle having a diameter of 14 inches.

$C = \pi d$
$\pi = 3\frac{1}{7}$
$d = 14$

$C = 3\frac{1}{7} \times 14$
$C = \frac{22}{7} \times 14 = 44$
The circumference is 44 inches.

4. What is the radius of the circle in problem **3**? Use the formula, $C = 2\pi r$, and find the circumference. Is the result the same as in problem **3**?

5. Find the circumference of the circle in problem **3** by using the value 3.14 for π. Is the result about the same as shown?

FINDING THE CIRCUMFERENCE OF A CIRCLE

Find the circumferences of the following circles:
(Use $\pi = 3\frac{1}{7}$.)

1. Diameter, 7 in.
2. Diameter, 6 ft.
3. Diameter, 105 ft.
4. Radius, 35 in.
5. Radius, 1 ft.
6. Diameter, $3\frac{1}{2}$ ft.
7. Diameter, 44 in.
8. Diameter, 10 in.
9. Radius, $3\frac{1}{2}$ ft.
10. Radius, 14 in.

11. On page 216 you found that the circumference of the wheel on Henry's bicycle was 88 inches. How many feet is that?

12. How many revolutions will the wheel of Henry's bicycle make in going a mile?

***13.** Frances said, "The number of revolutions a bicycle wheel makes in going a mile depends upon the speed at which the bicycle is travelling."

Jack said, "The number of revolutions which a bicycle wheel makes in travelling a mile is not changed by the speed; but the number of revolutions a minute does depend upon the speed." Which of these two statements is correct?

USING THE VOCABULARY OF ARITHMETIC

Define each of the following terms, or use it correctly in a sentence. If you do not know the meaning of a term, turn to the key page in parentheses.

acre	(197)	formula	(194)
altitude	(201)	parallelogram	(200)
area	(192)	perimeter	(198)
base	(201)	pi	(217)
circumference	(216)	section	(197)
diameter	(216)	trapezoid	(215)

LET'S PRACTISE

㉓

	a	*b*	*c*
1.	$37 \times 86 = ?$	$8145 \div 16 = ?$	$.1296 \div 36 = ?$
2.	$120 \div \frac{4}{5} = ?$	$3\frac{1}{2} \times 6\frac{2}{3} = ?$	$1926 \div .04 = ?$
3.	8% of 48 = ?	103% of 480 = ?	1.5% of 290 = ?
4.	24 = ? % of 72	1 = ? % of 100	5 = ? % of 5

5. $9.75 + 0.35 + 2.18 + 6.50 + 3.88 = ?$

6. $7\frac{1}{6} + 3\frac{1}{4} + 9\frac{1}{2} + 4\frac{7}{8} + 6\frac{1}{3} = ?$

7. Multiply 5 ft. 3 in. by 4.

8. Express as per cents: *a*. $\frac{1}{2}$; *b*. .6; *c*. $\frac{2}{3}$; *d*. .03; *e*. 2; *f*. .125; *g*. $\frac{2}{5}$; *h*. .015; *i*. 1.6; *j*. 1.025.

9. Express the following per cents as decimals or whole numbers: *a*. 12%; *b*. 4%; *c*. 20%; *d*. 500%; *e*. 102%.

10. Copy each example and insert the decimal point in the result:

a. $15 \times .25 = 375$
b. $.09 \times 8.7 = 783$
c. $.65 \times .65 = 4225$
d. $.02 \times .09 = 18$
e. $3.14 \times 5.5 = 17270$
f. $7.24 \div .01 = 724$
g. $71.4 \div .34 = 21$
h. $468 \div .26 = 18$
i. $.1442 \div .14 = 103$
j. $5.76 \div .24 = 24$

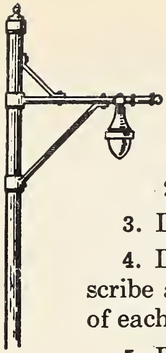
*TOPICS FOR SPECIAL REPORTS

1. If your community has a "planning board," find the duties of the board.

2. How did the acre come to be adopted as a unit for measuring land?

3. What is meant by a building permit? Why do cities require a permit before a building may be erected?

4. Find the area of your classroom; its window area; what per cent the floor area is of the window area. How much more or less is this than the minimum N. H. A. standards (page 191)?



A GEOMETRY CHECK-UP

1. Draw four different geometric figures, each having four sides. Name each figure.

2. Draw an angle of 70° and bisect it.

3. Draw a line 3 inches long and bisect it.

4. Draw a circle with a radius of 1 inch. Inscribe a hexagon in the circle. What is the length of each side of the hexagon?

5. Draw a circle with a radius of $1\frac{1}{2}$ inches. Inscribe an equilateral triangle in the circle.

6. If the side of an equilateral triangle is $2\frac{1}{2}$ inches, what is its perimeter?

7. What is the perimeter of a regular hexagon having a side of 1 inch?

8. Prove that a square, having a side of 4 inches, has a greater perimeter than the circumference of a circle which has a diameter of 4 inches.

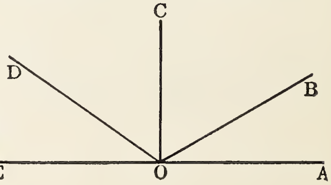
9. Draw a figure having four equal sides and angles which are not right angles.

10. The street lamp shown above is supported by a pole. Locate two straight angles; two right angles; two acute angles; one obtuse angle.

11. Make drawings to show the kinds of angles formed by the hands of a clock at:

a. 2:20 *b.* 1:25 *c.* 12:10 *d.* 12:30

12. Name a straight angle in the figure at the right; two obtuse angles; four acute angles; two right angles.



HOW WELL DO YOU REMEMBER?

1. What are some of the things which determine whether or not a family is well housed?

2. What units may be used in measuring area?

3. Give the formula for each of these: *a.* area of a rectangle; *b.* area of a triangle; *c.* circumference of a circle.

4. What is the difference between a parallelogram and a rectangle?

5. What is the difference between a parallelogram and a trapezoid? Draw each figure.

6. Find the area of a rectangle whose dimensions are as follows: *a.* length, 16 ft., width, $10\frac{1}{2}$ ft.; *b.* length, $8\frac{1}{2}$ in., width, $5\frac{1}{4}$ in.; *c.* length, 8.6 ft., width, 5.8 ft.

7. Why is the triangle used so generally in the construction of bridges and other structures which support heavy loads?

8. Find the area of a triangle whose dimensions are as follows: *a.* base, 9 ft., height, 7 ft.; *b.* base, $8\frac{1}{2}$ in., height, 14 in.; *c.* base, 54 ft., height, 37 ft.

9. Find the area of a parallelogram whose dimensions are as follows: *a.* base, 36 ft., width, 27 ft.; *b.* base, 18 inches, width, $10\frac{1}{2}$ inches.

10. What is the meaning of π? What is its approximate value?

11. Find the circumference of a circle when: *a.* $d = 8$ in.; *b.* $d = 27$ ft.; *c.* $d = 22$ in.; *d.* $r = 7$ ft.; *e.* $d = 3\frac{1}{2}$ mi. (Use $\pi = 3.14$)

12. What is the difference between the perimeter of a rectangle and its area? Find the perimeter and the area of a rectangle that is 16 feet long and 9 feet wide.

THINGS TO REMEMBER

1. *What is meant by a standard dwelling suitable for a family.*

2. *What unit is used for finding area.*

3. *How to find the area of a rectangle, a parallelogram, and a triangle.*

4. *How to find the circumference of a circle.*

5. *How to find the perimeter of a rectangle.*

TEST ON CHAPTER VII

1. If a living room is 18 feet long and 11 feet wide, what should be the least amount of its window area (Standard 2, page 191)?

2. A first bedroom should have at least 110 square feet of floor space. If a bedroom is 11 feet long, how wide must it be to meet this standard?

3. A berth in a Pullman car is 6 feet long and 35 inches wide. How much more or less space does this provide than a bed 76 inches long and 3 feet wide?

4. Find the area of a triangle whose dimensions are: *a*. base, 18 in., height, 14 in.; *b*. base, $7\frac{1}{2}$ ft., height, $5\frac{1}{2}$ ft.; *c*. base, 1 ft., height, 9 in.

5. If the opposite corners of a rectangle are joined, how many triangles are formed?

6. If a rectangle is $14\frac{1}{2}$ feet long and $8\frac{1}{2}$ feet wide, what is its perimeter?

7. If the diameter of a wheel is 7 feet, what is its circumference?

8. Using the result from problem 7, how many revolutions will this wheel make in travelling one mile?

9. Which will make more revolutions in travelling a mile, a wheel 28 inches in diameter or one 26 inches in diameter?

PROGRESS TEST

If you make errors on this test, turn to the key pages in parentheses where the work is explained.

1. Beginning with the smallest, arrange according to size: .1, .09, .17, .125, .056, 1. (68)

2. Multiply 496 by 308. Check the result. (15)

3. Divide 14250 by 375. Check the result by multiplication. (22)

4. 3% of $175 = ?$ (130)

5. 108% of $490 = ?$ (139)

6. 4.5% of $940 = ?$ (130)

7. $9\frac{1}{2} \times 38 = ?$ (48)

8. $450 \div .05 = ?$ (86)

9. $7\frac{1}{8} \div 12\frac{1}{2} = ?$ (54)

10. $36 = ?\ \%$ of 40 (136)

11. $40 = ?\ \%$ of 36 (136)

12. $320 = ?\ \%$ of 160 (136)

13. $7.5 \times 0.96 = ?$ (70)

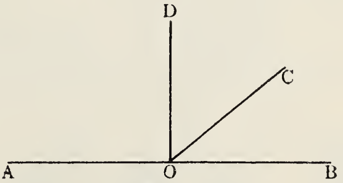
14. Find 24% of 360 degrees. (130)

15. State how to multiply a decimal by 1000. (75)

16. State how to divide a number by 1000. (75)

17. Construct a regular hexagon which has a side 2 inches long. (168)

18. Here are the four kinds of angles which you have studied. Name each angle. (170)

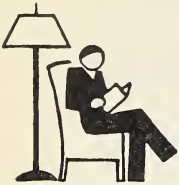


19. Draw an angle of 76° and bisect it. Check the accuracy of your construction by measuring each angle with your protractor. (182)

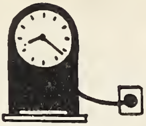
TO A NEW CHAPTER

WHAT ONE KILOWATT HOUR MEANS

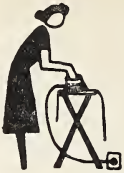
TO THE FARM HOME



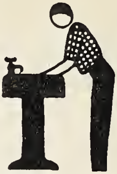
LIGHTING FOR AN EVENING'S READING



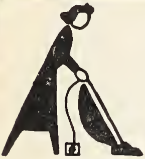
CORRECT TIME FOR THREE WEEKS



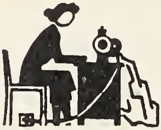
TWO HOURS OF EASY IRONING



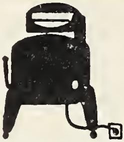
PUMPS ALL THE WATER WANTED FOR TWO DAYS



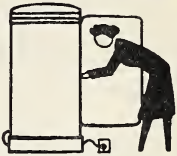
TWO THOROUGH HOUSE CLEANINGS



RUNS SEWING MACHINE TWO MONTHS WITH AVERAGE USE



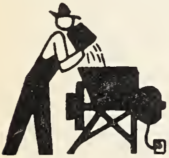
ONE LARGE WEEKLY WASH



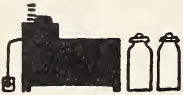
PRESERVES THE AVERAGE FAMILY'S FOOD FOR 15 HOURS

WHAT ONE KILOWATT HOUR MEANS

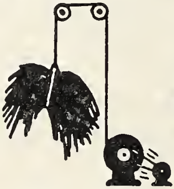
TO THE FARM



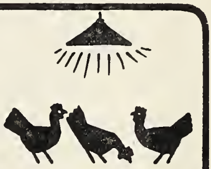
GRINDS 100 LB. OF GRAIN



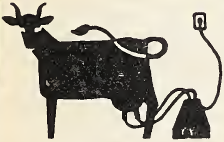
COOLS 10 GALLONS OF MILK FOR ONE DAY



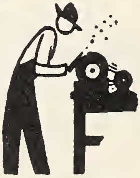
HOISTS TWO TONS OF HAY



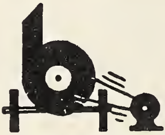
LIGHTS 100-BIRD POULTRY HOUSE FOR SIX DAYS



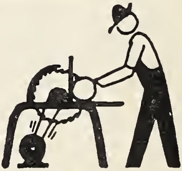
MILKS ONE COW FOR 20 DAYS



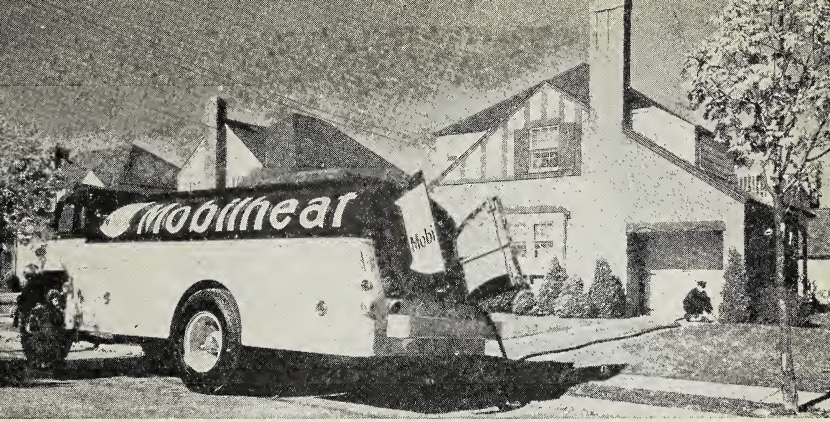
GRINDS 48 AXE HEADS OR 8 MOWER BLADES



CUTS ONE TON OF ENSILAGE



CUTS ONE-HALF CORD OF WOOD



CHAPTER VIII

MATHEMATICS IN THE HOME

In many parts of Canada oil for heating can be bought in lots of 1000 gallons or more at $\frac{1}{4}$¢ a gallon off the regular price. Mr. Martin's tank holds 1500 gallons, which permits him to take advantage of this saving.

1. In the early fall Mr. Martin bought 1000 gallons of fuel oil. How much did he save?

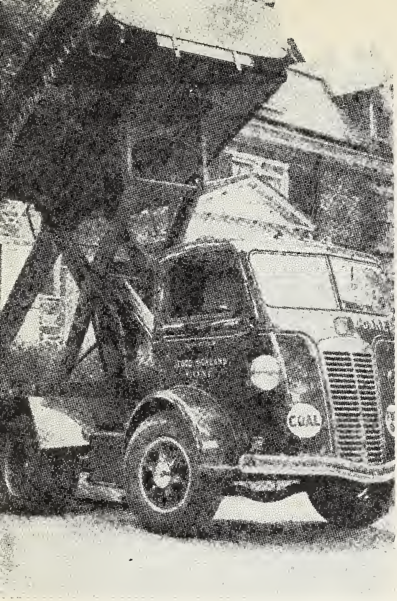
2. During the year he uses 2100 gallons. How much does he save by buying in quantities of 1000 gallons or more?

3. If the regular price of fuel oil is 13¢ a gallon, find the cost of 2000 gallons bought in 1000-gallon lots.

4. In a magazine article John read the following statement: "For heating purposes, oil at 13¢ a gallon costs about as much as coal at $18.20 a ton." At this rate, one ton of coal is equal in heat value to how many gallons of oil?

5. How many gallons of fuel oil have the same heat value as 9 tons of coal; as 12 tons of coal?

6. Which is cheaper and how much: coal at $12.00 a ton or fuel oil at 12¢ a gallon?



COAL AS FUEL

1. In some parts of our country, coal is the chief fuel used for heating. This is by no means its only use, as shown by the following table. How many pounds of coal of each ton mined are required for all the items? How many pounds are there in a ton?

Locomotives	380 lb.
Factories	420 lb.
Homes	400 lb.
Coke	300 lb.
Electric light and power	230 lb.
Making iron and steel	100 lb.
Export trade	70 lb.
Other uses	100 lb.

2. What per cent of the coal mined is used for each item?

3. Householders, as a group, do not regulate their furnaces properly. "Too much heat goes up the chimney," heating engineers say; and they give the following causes:

Cause of Heat Loss	Per cent of Heat Loss
Dampers out of order	40%
Failure to insulate (cover) furnace and pipes	20%
Soot	10%
Shaking live coals into the ashpit	5%

If a householder pays $12 a ton for coal, how much may he be losing by each cause listed? If he pays $10.50 a ton for coal?

4. If all four causes of heat loss are present in a furnace, what per cent of heat in the coal goes "up the chimney"?

★5. Construct a graph to show how a ton of coal is used.

★6. Construct a graph to show causes of heat loss.

CHECK YOUR OIL BURNER

1. We have not as yet learned, and we may never learn, how to use **all** the heat in coal, oil, or any other fuel. Some heat goes up the chimney or is wasted in other ways (page 226). How do you represent by per cent **all** the heat in a fuel?

2. An oil burner that uses 70% of the heat in fuel oil is a good burner. It is "efficient" as the heating engineers say. What per cent of the heat in fuel oil does such a burner waste?

3. Mr. Watson uses 1100 gallons of fuel oil a year. If his burner is "efficient" (70%), its heat loss is equivalent to how many gallons of fuel oil?

4. During rationing Mr. Watson's yearly allowance of fuel oil was 750 gallons. What per cent cut was this?

5. Mr. Martin's oil burner extracts but 56% of the heat from fuel oil. How much does this loss cost Martin if he uses 2100 gallons a year at 13¢ a gallon?

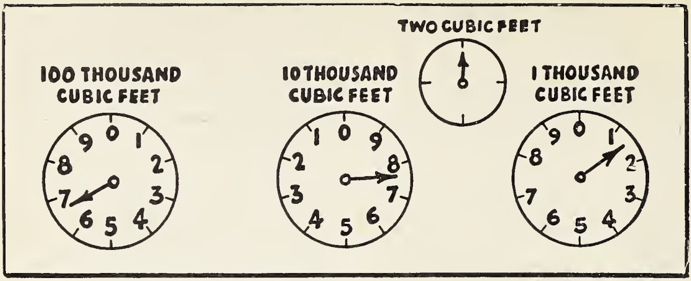
6. If Martin's oil burner were "efficient" (70%), how many gallons would be converted to heat? Not converted to heat?

7. Find the cost of the fuel loss in problem 6 at 13¢ a gallon.

8. Six families used about 1800 gallons of oil a family in one year for heating. Three of the families had their burners adjusted and got more heat from the fuel; three families neglected their furnaces and got less. How much oil a year did each of the first three families save? How much did the other families waste?

Family A From 50% to 60%
B From 60% to 70%
C From 55% to 75%

Family D From 70% to 60%
E From 60% to 54%
F From 80% to 72%



HEATING WITH GAS

A ring at the back door brought Martha. "I wish to read your gas meter in the basement," said the caller, showing his badge. In a few moments the man was back again and handed Martha a card.

The gas inspector had marked arrows on the card in the same positions as he found them on the dials of the meter.

1. According to the meter, what unit is used for measuring gas? (A cubic foot of gas is the amount of gas which may be contained in a space one foot wide, one foot long, one foot deep at a fixed pressure.)

2. The arrow points between what figures on the left dial? Use the smaller figure. How many cubic feet of gas are registered by this dial?

3. How many cubic feet of gas are registered on the centre dial? on the right dial? on all three dials?

4. The price of gas varies. If natural gas in town A, for example, cost $1.25 for the first 4000 cubic feet and 25¢ for each additional 1000 cubic feet, find the monthly and total costs of heating a house which used:

4,000	cu. ft. in	September	22,000	cu. ft. in	March
16,000	" " "	October	16,000	" " "	April
25,000	" " "	November	3,000	" " "	May
38,000	" " "	December	None	"	June
40,000	" " "	January	None	"	July
33,000	" " "	February	None	"	August

WHAT FUEL SHALL WE BURN?

Here is a new term in arithmetic for you to use—**British Thermal Unit,** abbreviated B.T.U. A B.T.U. is simply the amount of heat required to make one pound of water one degree warmer.

In his science book Ralph found a list of common fuels and the number of B.T.U. produced in burning **one pound** of each kind of fuel

wood (certain kind)	7,000	fuel oil	18,000
bituminous coal	12,000	coke	13,000
anthracite	11,000	kerosene	20,000

1. Find the number of B.T.U. in a ton of:

a. wood
b. bituminous coal
c. anthracite
d. fuel oil
e. coke
f. kerosene

2. The B.T.U. in a pound of bituminous coal are what fraction of the number in fuel oil? what per cent?

3. If you burn anthracite, 4.7% will be left in the form of ashes; bituminous coal, 1.1%; coke, 4%. How many pounds is this a ton of each fuel?

4. How many B.T.U. can you get for each dollar spent:

a. for wood at $8 a ton?
b. for bituminous coal at $6 a ton?
c. for anthracite at $10 a ton?
d. for fuel oil at $20 a ton?
e. for coke at $12 a ton?

*5. *a.* A quart of water weighs about 2½ pounds. Ordinary room temperature is 70°. You want the water to boil (212°). How many B.T.U. will you need?

b. What part of a pound of wood in burning will give off enough B.T.U. to boil the water?

INFORMATION PLEASE!

1. What is the largest number that can be written with three Arabic numbers? with three Roman numerals?

2. If 1 is divided by a proper fraction, will the quotient be more or less than 1?

3. How many thousandths are in .3?

4. At what hour do the hands of a clock form a straight angle?

5. A street extends north and south. You are walking southward on the street. Will the houses facing west on this street be to your left or to your right?

6. One circle has a larger radius than another circle. The two circles may be placed in six different positions. Name three of those positions. Make a drawing to show each position.

7. Name the consecutive (next to each other) months which have 31 days each.

8. If a square has a perimeter of 8 inches, what is its area?

9. A housewife allows about how many cupfuls of butter to a pound?

LET'S PRACTISE

24

1. $\begin{array}{r} 9.76 \\ 14.09 \\ 0.58 \\ 27.35 \\ 9.68 \\ \hline \end{array}$

2. $\begin{array}{r} 369 \\ \times 180 \\ \hline \end{array}$

3. $\begin{array}{r} 72480 \\ -38583 \\ \hline \end{array}$

4. $18\overline{)7315}$

5. $\begin{array}{r} 14\frac{1}{4} \\ -8\frac{5}{6} \\ \hline \end{array}$

6. $4\frac{1}{2} \times 7 = ?$

7. $6 \div \frac{8}{9} = ?$

8. $2.7\overline{)81}$

9. $5\frac{3}{8} \times 1\frac{2}{3} = ?$

10. $\begin{array}{r} 3.8 \\ \times .45 \\ \hline \end{array}$

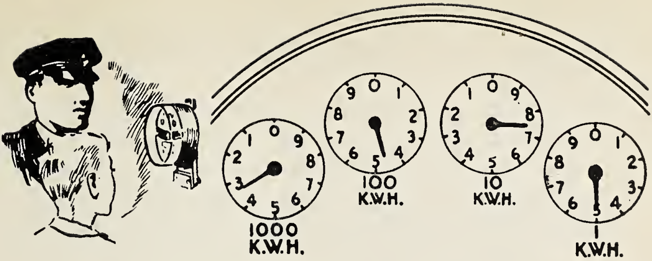
11. $5\frac{1}{4} + 2\frac{3}{8} + 9\frac{1}{2} = ?$

12. 36% of 450 = ?

13. 120% of 54 = ?

14. 16 = ? % of 24

15. 7 = ? % of 7


1000
K.W.H.
100
K.W.H.
10
K.W.H.
1
K.W.H.

READING AN ELECTRIC METER

"I have come to read your electric meter," said the caller, showing Frank his badge. Frank went along to see how the job was done.

"It is quite simple," continued the man. "Just read the dials on this meter."

1. According to the dials, what unit is used for measuring electricity? (A kilowatt hour, abbreviated K.W.H., is the amount of current used by a 1000-watt bulb in an hour.)

2. Many electric bulbs used for home lighting are 50 watts. How long will one of these bulbs burn on a K.W.H. of electric current? (HINT: 1000 ÷ 50 = ?)

3. How many 50-watt bulbs will burn for an hour on a K.W.H. of current?

4. The arrow on the left dial (the 1000 K.W.H. dial) points between what figures? Use the smaller figure. How many K.W.H. of electric current are registered on this dial?

5. How many K.W.H. are registered on the 100's dial? the 10's dial? the 1's dial?

6. How many K.W.H. are registered on all the dials?

*7. If you have an electric meter in your home, read it daily for one week and by subtracting, find the amount of current used each day.

THE COST OF ELECTRIC CURRENT

The Wilbur family receives bills for electric current monthly. On the back of each bill are the rates charged by the electric company.

$1.00 minimum including the first 11 K.W.H. a month
6¢ a K.W.H. for the next 11 K.W.H. a month
5¢ " " " " " 11 " " "
4¢ " " " " " 17 " " "
3¢ " " " " " 150 " " "
2¢ " " in excess of 200 " " "

1. During August the family was on vacation. What was their electric bill for that month?

2. If Mr. Wilbur returned home for a few days during the month, how much current may he use without increasing the bill for the month?

3. Find the cost of electricity for the Wilbur family during December if 68 K.W.H. were used.

The cost of the first 11 K.W.H. is	?
The cost of the next 11 K.W.H. is (11 × 6¢)	?
The cost of the next 11 K.W.H. is (11 × 5¢)	?
The cost of the next 17 K.W.H. is (17 × 4¢)	?
The cost of the next 18 K.W.H. is (18 × 3¢)	?
Total Cost	?

4. Mary Wilbur said, "In December we used more than 50 K.W.H. but less than 200 K.W.H. The rate should be 3¢ a K.W.H., and our bill should be 68 × 3¢, or $2.04.' Was Mary's reasoning correct? Explain.

5. Find the monthly cost of the following amounts of electric current at the rates charged the Wilbur family

a. 32 K.W.H.
b. 137 K.W.H.
c. 9 K.W.H.
d. 59 K.W.H.
e. 48 K.W.H.
f. 94 K.W.H

*6. Find the monthly cost (problem 5) in your community

REDDY KILOWATT AT WORK

REDDY KILOWATT

How electricity works for us at low wages is shown on page 224.

1. How long will a kilowatt hour of electricity run an electric clock?

2. How many kilowatt hours are consumed by an electric iron used 3 hours a week?

3. How many kilowatt hours are required to pump all the water needed during a month of 30 days? Find the cost of this current at 4¢ a K.W.H.

4. How many kilowatt hours would be used by a refrigerator in a month of 30 days? Find the cost of this current at an average of $3\frac{1}{2}$¢ a K.W.H.

5. How many kilowatt hours of current are required:

a. to cool 30 gallons of milk daily for one week (7 days)?

b. to milk a herd of 6 cows daily for 4 months (consider 30 days to the month)?

c. to light a 100-bird poultry house for one year?

d. to cut 10 cords of wood?

★6. What are some of the things which would change the amount of current used by the refrigerator (problem 4)?

LET'S PRACTISE

㉕

	a	*b*	*c*
1.	$9\frac{1}{2}+3\frac{7}{8}+\frac{5}{6}=?$	$\frac{1}{2}+\frac{7}{10}+4\frac{2}{5}=?$	$8.7+3.6+11.8=?$
2.	$8\frac{1}{6}-5\frac{3}{4}=?$	$5\frac{3}{4}\times 1\frac{1}{2}=?$	$9\div\frac{3}{8}=?$
3.	$11.2-10.9=?$	$3.4\div 17=?$	$.6\times .09=?$
4.	$15=?\%$ of 45	$30=?\%$ of 12	$7=?\%$ of 7
5.	6% of $72=?$	75% of $140=?$	210% of $360=?$

ELECTRICITY IN THE HOME

Susan made a list of the electrical appliances in her home, other than light bulbs. Then she found the amount of electric current required to run each appliance for one hour.

Fan	45 watts	Refrigerator	210 watts
Iron	500 watts	Sewing machine	75 watts
Doorbell	5 watts	Vacuum cleaner	100 watts

1. Find the cost, at 6¢ a K.W.H., to run the vacuum cleaner for 30 minutes; the sewing machine for 1½ hours; and the electric iron for 3½ hours.

2. What would it cost to use a 45-watt electric fan for six hours at 5½¢ a K.W.H.?

3. During April Mrs. Anderson's electric refrigerator used 50 K.W.H., her electric iron used 15 K.W.H., and her radio used 10 K.W.H. What was the total cost of operating these appliances at 5½¢ a K.W.H.?

4. Betty used a 100-watt electric bulb in her room an average of 2½ hours each night during November. What was the cost of the electricity at 6½¢ a K.W.H.?

5. Mrs. Arnold estimated that during April certain electrical appliances in her home used the amounts of electricity shown:

Clock, mixer, and sewing machine	4 K.W.H.
Toaster, vacuum cleaner, clothes washer	23 K.W.H.
Radio	8 K.W.H.

What was the total cost of electricity used at 5½¢ a K.W.H.?

FLOODLIGHTING A BALL PARK

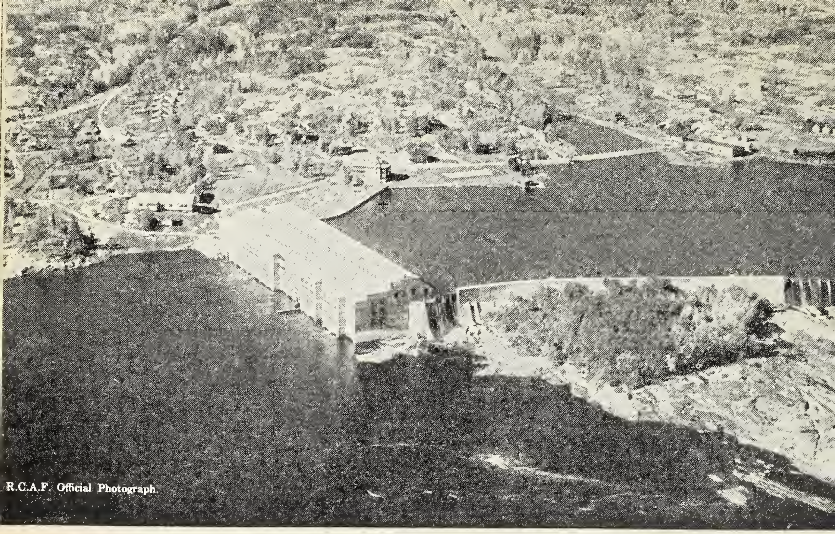
Two major-league baseball teams recently played a game at night before 60,000 "fans." People like to go to these night games after their day's work is done because floodlighting makes the playing field about as bright as sunlight, and with less glare and shadow.

1. One major-league baseball park is illuminated by seven hundred fifty-four 1500-watt bulbs. If all of the lights are on for 1 hour, how many K.W.H. are consumed?

2. If the lights are on for an average of 3 hours a game, find the cost of the electricity used at $4\frac{1}{2}$¢ a K.W.H.

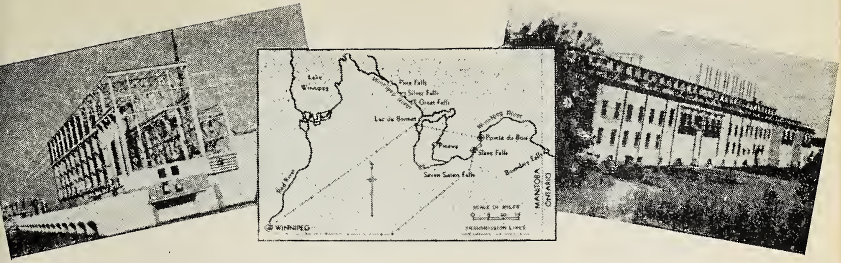
3. When another baseball team plays a home game at night, the cost for electric current is about $180. At an average of 3¢ a K.W.H., how many kilowatt hours of current are used?

★4. If the light from the 754 bulbs were combined into one beam, you would have light enough to read the print on this page about a mile from the light. How far from your study lamp at home are you able to read a line of this text?



The city of Winnipeg owns two power plants situated on the Winnipeg River, 80 miles north-east of Winnipeg, the power being transmitted to the city over steel tower transmission lines at 66,000 volts. The plant at Point du Bois, shown in the picture has a capacity of 105,000 horse power; the plant at Slave Falls has a capacity of 96,000 horse power.

1. What is the total capacity of the two plants?
2. How many 100 watt lamps could be kept burning by this power? (One horse power equals 746 watts).
3. How many K.W.H. could be generated by this power in a year of 365 days, if the plants operated an average of 12 hours a day?
4. What would be the sale value of this power (problem 3) at an average of one cent a K.W.H.?
5. Winnipeg is reputed to have the cheapest power of any city in the world. In a recent year the average cost a K.W.H. for domestic consumers was .792 cents. If the average home used 5649 K.W.H. in a year, what was the cost of power a year to the average consumer?


Lake Winnipeg
Pine Falls
Silver Falls
Great Falls
Winnipeg River
Lac du Bonnet
Winnipeg River
Pointe du Bois
Pinawa
Slave Falls
Boundary Falls
Seven Sisters Falls
Red River
MANITOBA
ONTARIO
SCALE OF MILES
WINNIPEG
TRANSMISSION LINES

MANITOBA'S POWER SUPPLY

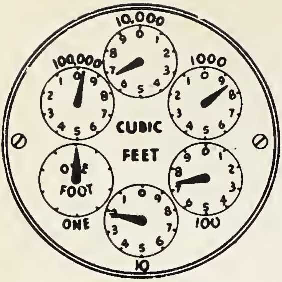
The source of nearly the entire electric power supply for the province of Manitoba is situated on the Winnipeg River as shown in the map. The City Hydro operates the plants at Point du Bois and Slave Falls with a total output of 201,000 horse-power, while the Winnipeg Electric Co. operates plants at Great Falls, Pinawa, and Seven Sisters with a total output of 310,500 horse-power. A sixth plant at Island Falls has a potential output of about 110,000 horse-power.

1. What is the total output of all the power plants in Manitoba?

2. In a recent year the total output of Manitoba hydro-electric plants was 1,863,374,850 K.W.H. Round off this figure to the nearest thousand; to the nearest million; to the nearest billion.

3. Manitoba has many power sites still undeveloped, the majority of these being on Northern rivers. The available power at these sites is 6,000,000 horse-power. What per cent of the total available power is at present being developed (see problem 1.)?

*4. What is meant by rural electrification? What plans are being made for rural electrification in your province?



MEASURING WATER FOR HOUSEHOLD USE

The Helms family has a water meter in its home. The meter measures in cubic feet all water piped into the house.

1. The family uses about 4300 cubic feet of water quarterly; that is, every 3 months. At $1.20 a 1000 cubic feet, how much does it pay for water a year?

4300 ÷ 1000 = ? , no. of thousand cubic feet.
4.3 × $1.20 = ? , the cost for three months.

2. At $1.10 a 1000 cubic feet, find the yearly cost to families which use cubic feet of water each quarter as follows:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
a.	3100	2800	4600	3300
b.	2900	3400	4200	3600
c.	3500	3800	4400	3000
d.	1900	2600	3100	2400

3. There are $6\frac{1}{4}$ gallons in one cubic foot of water. How many gallons of water are in 1650 cubic feet?

4. How many gallons a year does each family use?

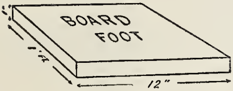
*5. A family uses an average of 3500 cubic feet of water a quarter. Which would cost more for one year and how much, a meter rate of $1.25 a 1000 cubic feet, or a flat rate of $1.50 a month?

*6. A certain city has a water rate of 36¢ a 100 cubic feet for the first 1200 cubic feet and 18¢ a 100 cubic feet for amounts in excess of 1200 cubic feet. At that rate, find the cost to a family that uses 1900 cubic feet a quarter.

*7. Find what the rate for water is in your community.

MEASURING AND BUYING LUMBER

From Canadian forests enormous quantities of lumber are produced every year. This lumber (boards, planks, etc.) is sawn from logs, in mills such as that shown in the above illustration. Then it is put in great piles to dry, and finally is shipped to lumber yards in cities and towns, to be sold to factories, builders, farmers and other users of lumber.



Lumber is measured by the **board foot (bd. ft.).** A board foot is a piece of lumber 1 inch thick, 12 inches wide and 1 foot long.

$1 \times \frac{12}{12} \times 1 = ?$

A piece of lumber 2″ thick, 12″ wide and 1′ long, contains 2 board feet. $2 \times \frac{12}{12} \times 1 = ?$

A piece of lumber $\frac{1}{2}$″ thick, 18″ wide and 8′ long contains 6 bd. ft. $\frac{1}{2} \times \frac{18}{12} \times 8 = ?$

To find the number of board feet in a piece of lumber, multiply the thickness in inches by the width in inches by the length in feet, and divide the result by 12. For example, a piece of lumber 2″ thick, 4″ wide, and 8′ long would contain $2 \times \frac{4}{12} \times 8 = \frac{16}{3}$ or $5\frac{1}{3}$ bd. ft.

1. For John's new dog house, he bought 4 boards, each 1″ thick, 12″ wide and 10′ long. How many board feet did he buy?

2. How much did it cost him at 6¢ a board foot?

3. John's father was laying a new floor for the cabin at the lake. For it, he needed the following:

5 pieces 2″ by 4″, 12 ft. long,
2 pieces 2″ by 4″, 8 ft. long,
26 pieces 1″ by 6″, 8 ft. long.

How many board feet did he buy?

4. 1000 board feet is usually written 1M. bd. ft. In a recent year, from Canadian forests were produced 4,512,232,000 bd. ft. Write this as (?) M. bd. ft.

5. When lumber is purchased in large quantities, the price is usually given in dollars a thousand (M) board feet. $80 per M. bd. ft. is ?¢ a bd. ft.?

6. Find the total number of bd. ft. in the following:

2 pieces 1″ × 10″, 6 ft. long
6 pieces 2″ × 8″, 10 ft. long
3 pieces 1½″ × 12″, 16 ft. long
10 pieces ½″ × 6″, 12 ft. long
24 pieces ¾″ × 4″, 18 ft. long.

7. At $65.00 per M., find the cost of the total number of board feet in problem **6**.

***8.** Visit a lumber yard, and find out where the various kinds of lumber are obtained. Get the prices of several kinds. Why is oak more expensive than fir? mahogany than pine?

***9.** Report to your class about grades of lumber, and the uses and prices of the various grades.

LET'S PRACTISE

26

Set I

	a	b	c
1.	$\frac{5}{6}+\frac{3}{4}+\frac{7}{8}=?$	$9.6+7.8+3.9=?$	$\frac{5}{6}\div 3=?$
2.	$.17+.95+.38=?$	$9\frac{1}{2}\times 4\frac{3}{4}=?$	$3.8\times 45=?$
3.	$15\div\frac{3}{4}=?$	$4.5\times 38=?$	$\frac{8}{9}\div\frac{1}{2}=?$
4.	$12\frac{1}{4}-7\frac{5}{6}=?$	$5738\div 13=?$	$92547\div 180=?$
5.	$706\times 4008=?$	$.8\times .07=?$	$98.8\div .26=?$

6. Add: $763+948+4103+540+357+92=?$

Set II

	a	b	c	d
1.	$\begin{array}{r} 24\frac{1}{4} \\ -7\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 7.345 \\ -1.008 \\ \hline \end{array}$	$\begin{array}{r} 41 \\ -9\frac{7}{8} \\ \hline \end{array}$	$\begin{array}{r} .090 \\ -.085 \\ \hline \end{array}$
2.	$9\overline{)\,.567}$	$.4\overline{)\,38}$	$.36\overline{)\,1.296}$	$3.7\overline{)\,.1776}$
3.	$\begin{array}{r} 938 \\ \times 409 \\ \hline \end{array}$	$\begin{array}{r} 70.4 \\ \times .06 \\ \hline \end{array}$	$\begin{array}{r} 325 \\ \times .025 \\ \hline \end{array}$	$\begin{array}{r} 4.27 \\ \times 1.5 \\ \hline \end{array}$

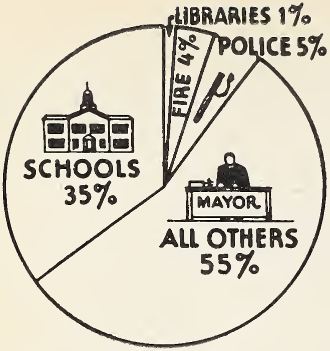
4. Find the decimal value of the following: *a.* $\frac{1}{8}$; *b.* $\frac{3}{4}$; *c.* $\frac{4}{5}$; *d.* $\frac{7}{8}$; *e.* $\frac{7}{20}$; *f.* $\frac{4}{25}$; *g.* $\frac{3}{16}$; *h.* $1\frac{3}{4}$; *i.* $2\frac{3}{8}$.

5. Round off the following to the nearest thousand: *a.* 7695; *b.* 4372; *c.* 9500; *d.* 7499; *e.* 500; *f.* 1510.

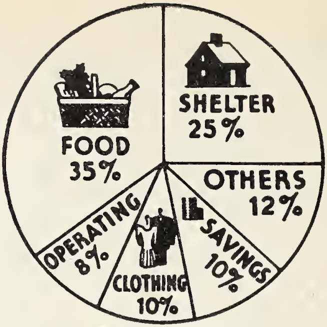
Set III

	a	b	c
1.	10% of 78 = ?	3% of 65 = ?	100% of 97 = ?
2.	120% of 45 = ?	208% of 1450 = ?	3.5% of 1230 = ?
3.	15 = ? % of 60	27 = ? % of 30	40 = ? % of 30
4.	36 = ? % of 720	144 = ? % of 36	2.5 = ? % of 100

5. Change the following to decimals or whole numbers: *a.* 12%; *b.* 125%; *c.* 70%; *d.* 400%; *e.* 2%; *f.* 101%.



CITY BUDGET



FAMILY BUDGET

LIVING BY A BUDGET

We have all heard about budgeting. A budget is simply a plan for the use of income.

1. At the top of this page is a circle graph of the city's budget. What per cent of its income does the city expect to spend for schools? police protection? fire protection?

2. If the city expects to receive $10,000,000 in taxes, how much of the money will it set aside for each item in its budget?

3. Also shown is a circle graph of a $2000 family budget. What per cent of the family income is devoted to food? to shelter? to operating costs? to clothing? to savings? to all other items?

4. Find the amount of money to be set aside for each item in the budget.

★5. Items in a family budget, based on an income of $3000, should be distributed about as follows: food, 30%; shelter, 25%; clothing, 15%; savings, 12%; other items, 18%. Show these amounts by a circle graph. How much money is allotted to each item in the budget?

BUDGETING A SMALL INCOME

Here is a budget for a family, based on an expected income of $20 a week.

Item	Expenditure	%
Food	$6.75	33.75
Shelter	4.50	?
Clothing	2.25	?
Fuel and light	1.50	?
Transportation (bus)	0.50	?
Recreation	0.50	?
Savings	1.00	?
All others	3.00	?
Total	?	?

1. Find the total expenditure and the per cents which are missing in the budget.

2. What is the yearly income of this family?

3. Suppose the $20-a-week family made its budget for a year. Would the amounts set aside for each item be more, the same, or less than the amounts given in its weekly budget? Would the per cents be more, the same, or less? Explain.

4. A suggested budget for a family, based on an expected weekly income of $50, is given below: Find the missing per cents in the budget.

Item	Expenditure	%
Food	$12.00	24.0
Shelter	9.50	?
Clothing	5.50	?
Fuel and light	3.50	?
Transportation (car)	5.00	?
Recreation	1.50	?
Savings	4.25	?
All others	8.75	?
Total	?	?

5. Which items in the $50 budget have larger per cents than corresponding items in the $20 budget?

*6. Tell why a family with a weekly income of $50 may set aside a larger per cent of its income for recreation and a smaller percentage for food than a family having a weekly income of $20.

A BUSINESS GIRL'S BUDGET

Here are budgets of two business girls. One of the girls is away from home; the other girl lives with her family.

Items	Living Alone	Living with Family
Home expenses	\$599.11	\$489.11
Clothing	182.76	182.76
Clothing upkeep	13.42	11.46
Personal care	36.00	36.00
Medical care	62.46	62.46
Savings	70.63	182.59
Recreation	110.19	110.19
All others	88.60	88.60
Total	?	?

1. Find the total of each budget.

2. How much more does the girl away from home spend (not including savings) than the girl living with her family?

3. The item "home expenses" represents approximately what per cent of the total budget of each girl?

*4. Why do you think the size or the location of a city might affect the living costs of a young person? of a family?

LET'S PRACTISE

27

	a	*b*	*c*
1.	$28\overline{)1820}$	$3.6\overline{)2.196}$	$.14\overline{)3.864}$
2.	$12\frac{1}{2} - 8\frac{2}{3} = ?$	$3\frac{1}{7} \times 12\frac{1}{2} = ?$	$9\frac{1}{4} + 6\frac{2}{3} + 1\frac{5}{6} = ?$
3.	$60 \div \frac{5}{6} = ?$	$8\frac{1}{4} \div 2\frac{1}{2} = ?$	$9.6 \times 1.03 = ?$
4.	$.03 = ?\,\%$	$1.5 = ?\%$	$1.025 = ?\,\%$
5.	8% of $160 = ?$	4.5% of $600 = ?$	175% of $90 = ?$
6.	$13 = ?\,\%$ of 52	$300 = ?\,\%$ of 100	$48 = ?\,\%$ of 72

7. Find the smallest common denominator for fractions having denominators of: *a.* 2, 4, and 6; *b.* 3, 6, and 9; *c.* 2, 3, 4, and 8; *d.* 3, 4, 6, and 8.

8. Change the following to per cents: *a.* .35; *b.* $\frac{1}{4}$; *c.* $\frac{1}{5}$; *d.* .6; *e.* $\frac{2}{3}$; *f.* 2.

WISE PURCHASING

Many families find it easier to live within their budgets because they:

a. Buy in quantities whenever possible.

b. Make sure their purchases are accurately measured or weighed.

c. Take advantage of sales or "specials."

d. Compare prices in different stores and buy where they get the best value for their money.

e. Read the labels on canned and bottled foods to find what and how much the package contains.

Each of the five problems below illustrates one of the five principles given above. Solve the problem and state which principle of wise purchasing is illustrated.

1. A can of fruit juice, regularly priced at 40¢, was offered at a special sale for 32¢. What was the saving? the per cent saving?

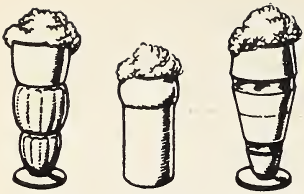
2. Potatoes sold at 5 pounds for 12¢ or $1.85 a 100-pound bag. How much could be saved by buying by the bag?

3. At one store evaporated milk sold at 3 cans for 19¢. At another store the same brand was priced at 4 cans for 23¢. Find the difference in price a can.

4. Mrs. Abbott bought a quart package of ice cream (containing 50% air) for 40¢. Bulk ice cream (containing 30% air) sold at 50¢ a quart. Which was the better buy?

5. Maple syrup, in fancy bottles containing 12 flui ounces, was priced at 14¢; in tin cans containing 16 flui ounces, at 15¢. Which was the cheaper way to purchase the syrup?

★**6.** Report examples, illustrating these principles of wise purchasing.



GETTING YOUR MONEY'S WORTH

Here are three ice cream sodas, any one of which Mary may have. Which one will she choose? Why? We are afraid you are wrong. All three glasses contain the same quantity of soda.

1. Why cannot the amount of contents be told by the shape of the container?

2. Can you tell the amount of contents in a paper or cardboard container without reading the label? Explain.

3. Buying in large quantities usually is cheaper than buying in small quantities. State why this is true.

4. Which is the better way to buy fruits and vegetables, by weight or by basket measure? Why?

5. In some localities bananas are sold by the pound instead of by the dozen. Which is the better way?

6. Ice cream is sold either in bulk or in packages. Which of these two forms is usually the more sanitary?

7. Mary priced ice cream. "50¢ a quart in packages, 60¢ in bulk," said the salesman. "If I scoop it out of the can (in **bulk**), you get 32 ounces to a quart; if I sell you a quart package, you get 20 ounces." Which form is the cheaper buy for Mary, and how much cheaper a quart?

8. A gallon of ice cream must weigh at least 5 pounds. How much is this a quart? a pint?

9. Various foods products used in making ice cream weigh about 9.2 pounds to a gallon. If ice cream must weigh at least 5 pounds to a gallon, can more or less

than 2 gallons of ice cream be made from a gallon of the food products?

10. A 12-ounce jar of jam was priced at 30¢, a pound jar at 36¢. What was the difference an ounce in price?

11. A jar of salad dressing containing 6 fluid ounces was priced at 20¢; a jar containing a pint (16 fluid ounces) of the same kind of dressing, at 45¢. Find the difference in cost of the dressing a fluid ounce.

12. Jerry noticed that new potatoes were priced 3 pounds for 19¢ in one store, 4 pounds for 25¢ in another. He thought the first rate was the cheaper. Was it cheaper or more expensive, and how much a pound?

13. Grapefruit were marked 4 for 25¢. Martha bought one grapefruit and paid 7¢, not 6¢. Martha thought the grocer made an error. What do you think?

14. A certain kind of tomato juice is priced as follows:

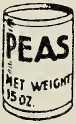
3 small cans for 20¢, each containing 14 fluid ounces
3 medium-size cans for 25¢, each containing 20 fluid ounces
1 large-size can for 20¢, containing 50 fluid ounces

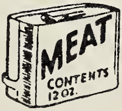
a. How many ounces may be bought for one cent in the small-size cans? the medium-size cans? the large can?

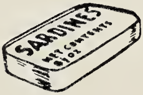
b. How much more tomato juice will one cent buy in the medium-size can than in the small can? in the large can than in the medium? in the large can than in the small can?

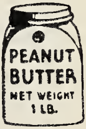
15. *a.* What foods are shown below?

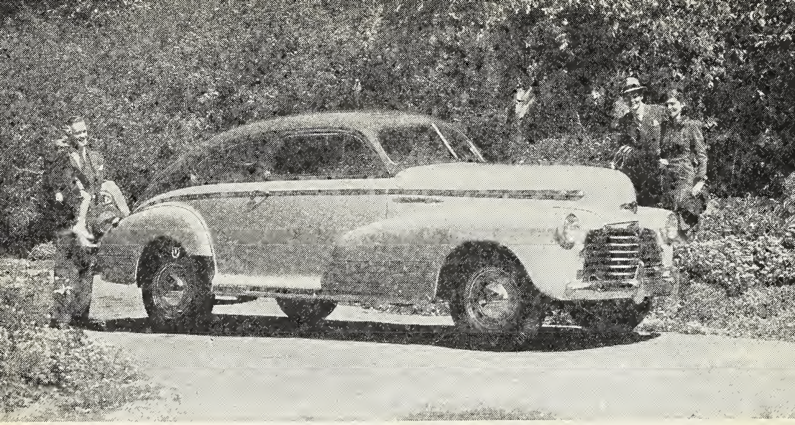
b. What quantity of food does each package contain?











BUDGETING THE CAR

Mr. Snyder made a budget of the operating costs of his automobile for one year. The items he included were:

a.	8000 mi., 20 mi. to each gallon of gasoline, at 35¢ a gallon	$?
b.	8 changes of oil at $2.10 each	?
c.	8 extra quarts of oil at 35¢ a qt.	?
d.	Tires and tubes	30.00
e.	Insurance	50.00
f.	Maintenance	36.00
g.	Depreciation	200.00
h.	License fees	15.00
i.	Extras	25.00
	Total	?

1. Find items *a*, *b*, and *c* in the table.

2. What was the total estimated cost of operating the car for one year?

3. What is meant by each of the items in the table?

4. Mr. Snyder estimated that his car cost him about 6¢ a mile to operate. Is this true?

5. If Mr. Snyder's annual income is $4000, what per cent of his income is budgeted to the cost of operating his car?

Income					Expenditures				
194- June	1	Monthly allowance	1	00	194- June	2	Movies		10
	4	Running errands		50		5	Soda		10
	5	Helping in store	1	00		7	Church		10
	12	Mowing lawn		75		10	Baseball	1	25
	18	Delivering papers	1	00		12	Movies		10
	20	Delivering posters		35		14	Church		10
	26	Running errands		25		15	Bus fare		25
	27	Mowing lawns		75		20	Candy		25
	29	Fishing bait		75		21	Church		10
						24	Bathing suit	1	75
						26	Movies		10
						28	Church		10
						30	Deposited in savings bank	1	50
						30	Cash balance	1	?
				?					?
July	1	Bal. on hand.		?					

A PERSONAL CASH RECORD

Sid keeps a record of his earnings and expenses for each month. This enables him to live within his budget. Above is shown his record of money received and spent for the month of June.

1. Find Sid's cash balance as of June 30. (The cash balance is the difference between the total **income** and the total **expenditures.**) Notice how and where the balance is brought down as of July 1.

2. If Sid had not received an allowance, and if he had not deposited any money in a savings account, how much would his cash balance have been on June 30?

3. The amount which Sid saved was the amount of his savings bank deposit. This amount was what per cent of his total monthly income?

4. "Always keep a record of the money you receive, Sid," said his father, "and of the money you pay out. This is the first rule in learning to save money."

Tell why you do or do not agree with Sid's father.

KEEPING A PERSONAL CASHBOOK

Anybody can keep a simple cash record.

a. Rule a form like the cash record (page 249).

b. Enter all money received (with date received) on the **left-hand** side of the cash record.

c. Enter money paid out (with date paid) on the **right-hand** side of the cash record.

d. Subtract "Expenditures" from "Income" and enter the difference as "Cash balance" on the **right-hand** side of the record and as of the last day of the month.

e. Rule off the form as shown on page 249.

f. Bring down the balance as of the first of the following month.

1. Rule a cash record. Enter Grace Nelson's income and expenditures for November. Find her cash balance. Rule off the record. Bring down the balance.

Nov.	1	Allowance	$2.00
	3	Carfare	.10
	6	Church	.10
	8	Confections	.15
	9	Football game	.50
	13	Church	.10
	16	Earned from sale of Christmas cards	1.25
	19	Bus fare	.75
	25	Earned from Christmas card sale	.75
	27	Church	.20
	29	Book	.75
	30	Deposited in a savings bank	1.00

a. What was Grace's cash balance as of November 30?

b. What per cent of Grace's monthly income was her saving-fund deposit?

***2.** Keep a cash record of your income and expenditures for a month. Balance and rule off the form at the end of the month and bring down the new balance as of the first of the following month.

USING THE VOCABULARY OF ARITHMETIC

Tell what is meant by each of the following terms. If you cannot define the term, use it correctly in a sentence. The key number in parentheses shows the page on which the term is used.

area	(192)	equilateral triangle	(168)
budget	(242)	K. W. H.	(231)
B. T. U.	(229)	obtuse angle	(170)
board foot	(239)	parallel lines	(157)
cash balance	(249)	perpendicular lines	(158)
circumference	(216)	personal cash record	(249)
concentric circles	(166)	scale drawing	(160)
cubic foot	(228)	truss bridge	(204)
diameter	(164)		

⋆TOPICS FOR SPECIAL REPORTS

1. Select some street in your community and find how many of the homes are heated by oil, by coal, and by gas. From this study, estimate about what per cent of the homes in your community are heated by each kind of fuel.

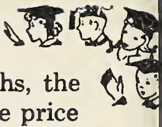
2. Find any differences in cost for the same brands of food products at stores in your neighborhood. Determine how much could be saved on each dollar spent by making purchases at the store offering the best price.

3. Suggest several ways in which you can help your family live within its budget.

4. For breakfast, a boy or girl about your age should eat food containing from 600 to 800 calories. Select a suitable breakfast which will provide the right number of calories.

5. Keep a record of all your income and expenditures during a week.

HOW WELL DO YOU REMEMBER?



1. If fuel oil is bought during the summer months, the price may be 13¢ a gallon, but after September the price may be 13½¢ a gallon. What is the saving by buying 1200 gallons during the summer months? the per cent saving?

2. About 140 gallons of fuel oil produce the same amount of heat as 1 ton of coal. If coal sells for $12 a ton, at what price should a gallon of fuel oil sell?

3. By better regulation of the furnace dampers, Mr. Barnes was able to save 15% of the heat value of coal. What was the value of this saving if coal cost $10.50 a ton and he burned 12 tons?

4. A burner on a gas range consumes about 8 cubic feet of gas an hour. If Mrs. Mallory uses 3 burners, on the average, an hour a day for cooking, how much gas does she use in a month of 30 days? At $1.80 a 1000 cubic feet, find the cost of the gas.

5. An electric light company charges $1 for the first 10 K.W.H.; 5¢ a K.W.H. for the next 40 K.W.H.; 4½¢ a K.W.H. for the next 150 K.W.H. What is the cost to a consumer who uses 86 K.W.H. in a month?

6. At the rate of 24¢ a 1000 gallons, what will be the cost of 1800 cubic feet of water? (6¼ gallons to the cu. ft.)

7. A budget allotment for a family having a yearly income of $2400 is as follows: food, 35%; shelter, 25%; clothing, 14%; savings, 10%; other items, 16%. Show these amounts by a circle graph. How much money is allotted to each item in a budget of $2400?

8. Tomato juice sells for 10¢ a can or 3 cans for 25¢. What is the saving by buying in quantities of 3 cans? the per cent saving?

THINGS TO REMEMBER

1. *How gas, electric current, and water consumed in the home are measured.*
2. *What is meant by budgeting.*
3. *How to exercise economy in making purchases of food.*

TEST ON CHAPTER VIII

1. What unit is usually used for measuring heat produced by coal, fuel oil, gas, coke?

2. What unit is used for measuring water piped into a home? electric current?

3. What is meant by a **minimum** monthly charge for electric current or for gas?

4. Give some of the chief uses of a family budget.

5. A family with an income of \$2500 allots 30% for food, 15% for clothing, 20% for shelter, 15% for savings, and the balance for other items. How much money is allotted for each purpose?

6. Tom's mother can buy sugar at 6¢ a pound or \$1.38 for a bag containing 25 pounds. What per cent does she save by buying 25-pound bags?

7. Frank bought 24 pieces of 2 in. × 4 in. lumber, 6 ft. long at \$55 per M. How much did he pay for it?

8. Assume you earn 50¢ each week in addition to your allowance of \$1.50. Carfare costs 15¢ each school day; school lunch, 10¢; and savings, 5% of your income.

Make up a cash record of your income and expenditures for February. (Assume that February 1 came on Monday; that February contained 2 school holidays; and that you had other expenses in addition to lunch, carfare, and savings.)

PROGRESS TEST IN PROBLEM SOLVING

1. If a knot is equal to 1.15 miles per hour, what is the speed in miles per hour of a boat which travels at 26 knots? (70)

2. Give the place value of each figure in the number 473.12. (65)

3. If a car travels 42 miles in $\frac{3}{4}$ hour, what is the rate of the car in miles an hour? (58)

4. The cost of 1000 bricks is $35.50. At that rate, what is the cost of each brick? of 100 bricks? (75)

5. Mr. West took an automobile trip of 2136 miles and used 118 gallons of gasoline. To the nearest tenth of a mile, what was his average mileage for each gallon of gasoline? (77)

6. There are 39 quarts in 100 pounds of milk. When milk sells for $1.75 for 100 pounds, what is the cost, to the nearest tenth of a cent, of one quart? (77)

7. A baseball player was at bat 156 times and made 51 hits. Find his batting average to three decimal places. (80)

8. The floor plan of a room is drawn to a scale 1″ = 8′. What are the dimensions on the plan to show a room 14 feet by 21 feet? (162)

9. One pound of grass seed will sow 200 square feet of new lawn. At that rate, how many pounds of grass seed are needed to sow a rectangular lawn 60 feet by 25 feet? (196)

10. A circular fountain has a diameter of 35 feet. What is the shortest distance around the fountain? (217)

If you had trouble with any problem, turn to the key page in parentheses where the work is explained.

TO A NEW CHAPTER

CHAPTER IX

MATHEMATICS OF BUSINESS

"Better open an account, and deposit that money in the bank," said Mr. Carter to John, as he was leaving for business.

"But I want to use some of it soon," John replied.

"If you open a current account," said his father, "you can pay your bills by cheque. The bank will return your cheques to you after they have honoured them, and then you will have proof that the bills are paid."

"That's a splendid idea," said John. "I think I'll go to the Bank of Montreal. It's nearest to your office, isn't it, dad?"

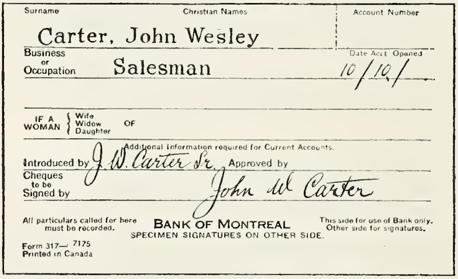
The safekeeping of money is only one of the many services which John found the banks could offer. Some of these services you will study in this chapter.

OPENING A BANK ACCOUNT

When John opens his account in the Bank of Montreal, he may at any time leave money with the bank for safekeeping. He is then a **depositor** of the bank.

He may **withdraw** his money, or any part of it, as he needs it. This is done by writing a **cheque,** which is a written order to the bank signed by himself as a depositor, to pay out money.

At the bank, John told the clerk he wished to open an account. The clerk then gave John a card, as illustrated below, to fill in. His full name, and his **signature** (the way he usually signs his name) are written on the card, and kept by the bank, to compare with signatures on cheques which may be written on his account.



Surname Christian Names
Carter, John Wesley
Account Number
Business or Occupation Salesman
Date Acct Opened 10/10/
IF A WOMAN { Wife Widow Daughter OF
Additional Information required for Current Accounts.
Introduced by J. W. Carter Sr. Approved by
Cheques to be Signed by John W Carter
All particulars called for here must be recorded.
BANK OF MONTREAL
SPECIMEN SIGNATURES ON OTHER SIDE.
This side for use of Bank only. Other side for signatures.
Form 317— 7175
Printed in Canada

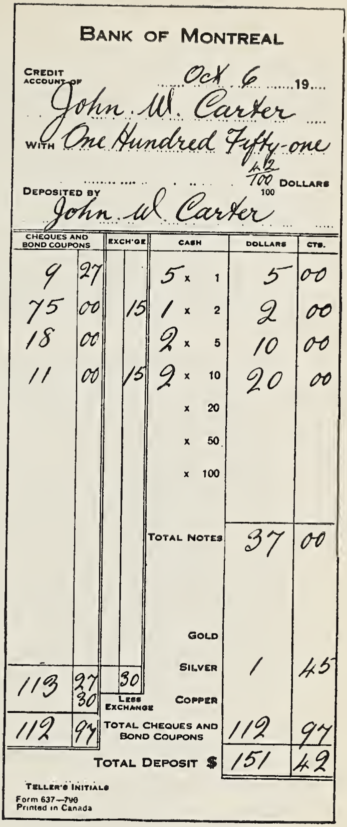
1. Is John's signature his full name? How may a signature differ from a full name? Write your full name? Your signature?

2. John signed one of his cheques J. W. Carter. The cheque was **dishonoured,** that is, the bank refused to pay it. Why?

3. One day, John absent-mindedly wrote $72.00 on a cheque, instead of $27.00. He had only $50.00 on deposit. The cheque was dishonoured. Why?

THE DEPOSIT SLIP

At the bank, a clerk showed John how to fill in the deposit slip.



BANK OF MONTREAL

CREDIT ACCOUNT OF John W. Carter Oct 6 19....

WITH One Hundred Fifty-one 42/100 DOLLARS

DEPOSITED BY John W. Carter

Cheques and Bond Coupons		Exch'ge	Cash	Dollars	Cts.
9	27		5 x 1	5	00
75	00	15	1 x 2	2	00
18	00		2 x 5	10	00
11	00	15	2 x 10	20	00
			x 20		
			x 50		
			x 100		
			Total Notes	37	00
			Gold		
			Silver	1	45
113	97	30			
	30	Less Exchange	Copper		
112	97		Total Cheques and Bond Coupons	112	97
			Total Deposit $	151	42

Teller's Initials

Form 637—7M
Printed in Canada

1. In what bank is John's money to be deposited?

2. When was the deposit made? by whom?

3. How much was the total deposit?

4. How much of the deposit was in silver? in bank notes? in cheques?

5. Two of the cheques were **drawn** on banks outside of Winnipeg. The bank charges 15¢ **exchange** on each of these? Why? What was the difference in the final deposit amount caused by exchange?

6. Rule and letter a deposit slip, or obtain one from your local bank. Then enter the following deposit: Silver, $2.85; notes, seven one's; three two's; eight five's; two ten's; one twenty; cheques, $16.10, $23.94, $81.25; Exchange, 15c. What is the amount of the **total deposit.**

JOHN CARTER'S CURRENT ACCOUNT

Before leaving the bank, John was given a cheque book. Then he went to the Community Garage to pay for repairs to the family car. Here is the **cheque stub** which he filled in before he wrote the cheque shown on Page 259.

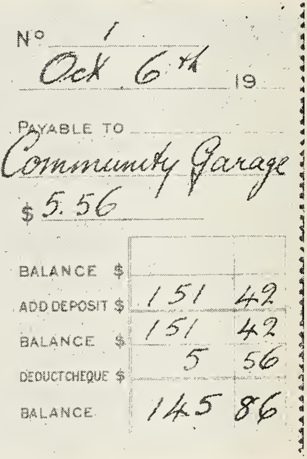
1. Who receives the cheque? Who retains the stub?

2. **The stub:** What is the number of the cheque to be written? its amount? its date? payable to whom?

3. What was John Carter's cheque-book balance before writing the cheque? after the cheque was drawn?

4. What **balance** should he write on the stub for cheque No. 2?

5. **The cheque:** What is its number? date? payable to? drawn by? on what bank?



N° 1

Oct 6th 19

PAYABLE TO

Community Garage

$ 5.56

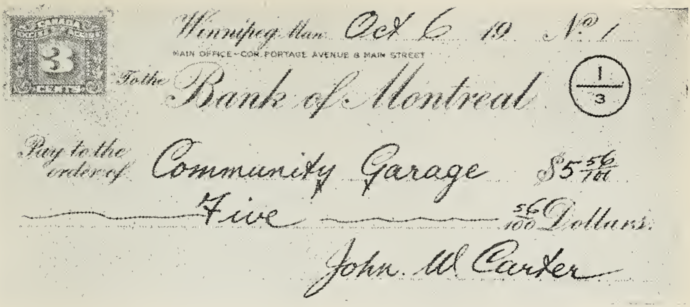
BALANCE $		
ADD DEPOSIT $	151	42
BALANCE $	151	42
DEDUCT CHEQUE $	5	56
BALANCE	145	86

6. The amount appears twice on the cheque. Why was the amount written both in figures and in words and figures? Why are there wavy lines on the cheque?

7. Why should the stub always be filled in before the cheque is written?

8. Rule and letter a stub and cheque form. Write a cheque for $106.23, supplying all other details.

Before Mr. Williams, owner of the Community Garage, can cash the cheque, or deposit it in his own account, he must **endorse** it; that is, he must write his name on the back, and close to the top of the paper.



Winnipeg, Man. Oct 6 19 No. 1

MAIN OFFICE—COR. PORTAGE AVENUE & MAIN STREET

To the Bank of Montreal $\frac{1}{3}$

Pay to the order of Community Garage $\$5\frac{56}{100}$

Five $\frac{56}{100}$ Dollars.

John. W. Carter

Cheques pass from person to person almost as freely as does money. Sometimes dishonest people change the amount on a cheque, or sign another person's name. Such dishonest practices cannot be prevented, but they can be made very difficult, by remembering the following:

a. Always sign a cheque in ink, never in pencil. (Items of the cheque, other than the signature, may be typed or printed.)

b. Use the same signature as on the signature card.

c. Deposit or cash all cheques as soon as possible.

d. Never erase on a cheque. If an error is made, mark the cheque stub void. Destroy the cheque and write a new one.

e. Notify the bank when a cheque has been lost or stolen.

f. Never cash a cheque for a stranger.

g. All cheques which you sign are returned to you **cancelled** (marked by your bank so they cannot be used again). Cancelled cheques are receipts for payment of the amount written on the face of each cheque. Save them.

h. Never endorse a cheque in blank until you are ready to deposit or cash it.

1. Tell why you should follow each of the suggestions listed for the use of cheques.

2. Some cheques are written on **safety paper**. What are the advantages of this kind of cheque paper?

WAYS OF SENDING MONEY

1. John Carter pays bills by cheque in person. He also sends cheques freely through the mails, with little fear of loss. Why does John mail cheques in preference to like amounts in currency?

2. Money may also be sent safely by **post office money order.** Where may these be purchased? The rates are given in the following table:

From	$ 0.01	to	$ 5.00	10¢
From	5.01	to	10.00	12¢
From	10.01	to	20.00	16¢
From	20.01	to	40.00	18¢
From	$40.01	to	$ 60.00	21¢
From	60.01	to	80.00	23¢
From	80.01	to	100.00	27¢

(a) Does the charge double as the amount of the money order doubles?

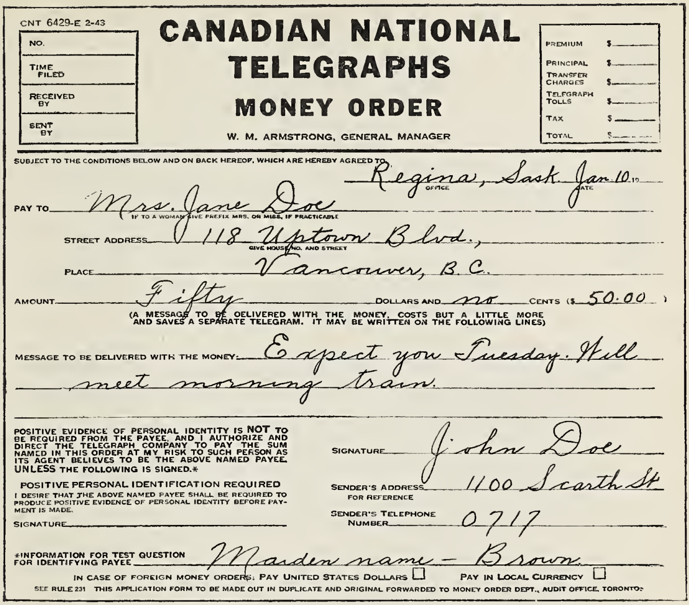
(b) What is the cost of a post office money order for $1.10? $5? $10.25? $50? $75? $79.95?

3. Mr. Rowe wishes to pay with a money order for goods bought through a mail-order house. If the goods cost $9.45, how much must he pay to the post office in order to receive the money order?

4. Telegraph companies transfer money safely by use of **telegraphic money orders.** This service is available for unlimited amounts in large offices, but is limited to $100 in certain smaller centres. The charges for this service are: one per cent of the amount wired, with a minimum of 25¢, plus double the telegram cost to whatever city the money is sent, plus federal tax which may be in effect (7¢ at present).

The cost of sending $50 from Winnipeg to Regina would be 50¢, plus 90¢ (see p. 45), plus 7¢ or $1.47.

Find the cost of telegraphing $100 from Winnipeg to (a) Saskatoon, (b) Edmonton, (c) Vancouver, (see p. 45 for telegraph rates.)



CNT 6429-E 2-43

NO.

TIME FILED

RECEIVED BY

SENT BY

CANADIAN NATIONAL TELEGRAPHS

MONEY ORDER

W. M. ARMSTRONG, GENERAL MANAGER

PREMIUM $

PRINCIPAL $

TRANSFER CHARGES $

TELEGRAPH TOLLS $

TAX $

TOTAL $

SUBJECT TO THE CONDITIONS BELOW AND ON BACK HEREOF, WHICH ARE HEREBY AGREED TO

Regina, Sask Jan. 10 19

OFFICE DATE

PAY TO Mrs. Jane Doe

IF TO A WOMAN GIVE PREFIX MRS. OR MISS, IF PRACTICABLE

STREET ADDRESS 118 Uptown Blvd.,

GIVE HOUSE NO. AND STREET

PLACE Vancouver, B.C.

AMOUNT Fifty DOLLARS AND no CENTS ($ 50.00)

(A MESSAGE TO BE DELIVERED WITH THE MONEY, COSTS BUT A LITTLE MORE AND SAVES A SEPARATE TELEGRAM. IT MAY BE WRITTEN ON THE FOLLOWING LINES)

MESSAGE TO BE DELIVERED WITH THE MONEY: Expect you Tuesday. Will meet morning train.

POSITIVE EVIDENCE OF PERSONAL IDENTITY IS **NOT** TO BE REQUIRED FROM THE PAYEE, AND I AUTHORIZE AND DIRECT THE TELEGRAPH COMPANY TO PAY THE SUM NAMED IN THIS ORDER AT MY RISK TO SUCH PERSON AS ITS AGENT BELIEVES TO BE THE ABOVE NAMED PAYEE, **UNLESS** THE FOLLOWING IS SIGNED.*

SIGNATURE John Doe

SENDER'S ADDRESS FOR REFERENCE 1100 Scarth St

POSITIVE PERSONAL IDENTIFICATION REQUIRED

I DESIRE THAT THE ABOVE NAMED PAYEE SHALL BE REQUIRED TO PRODUCE POSITIVE EVIDENCE OF PERSONAL IDENTITY BEFORE PAYMENT IS MADE.

SIGNATURE

SENDER'S TELEPHONE NUMBER 0717

*INFORMATION FOR TEST QUESTION FOR IDENTIFYING PAYEE Maiden name - Brown.

IN CASE OF FOREIGN MONEY ORDERS: PAY UNITED STATES DOLLARS ☐ PAY IN LOCAL CURRENCY ☐

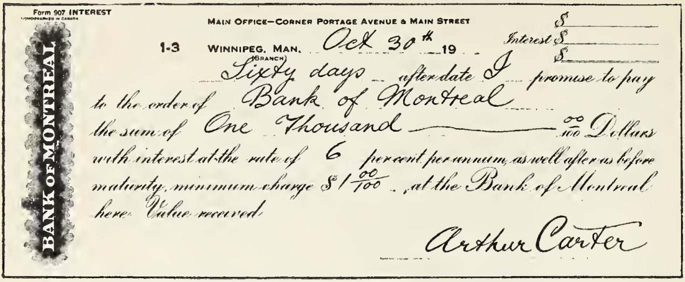
SEE RULE 231 THIS APPLICATION FORM TO BE MADE OUT IN DUPLICATE AND ORIGINAL FORWARDED TO MONEY ORDER DEPT., AUDIT OFFICE, TORONTO.

5. Upon what does the cost of telegraphing money depend?

6. How much more does a $100 telegraphic money order from Winnipeg to Edmonton cost than a post office money order for the same amount? Under what conditions would you pay the extra cost to telegraph the money?

*7. Select one of the following topics for a brief report to your class:

(a) Bank drafts and how to use them.
(b) Postal notes.
(c) How cheques are cleared.
(d) The traveller's cheque.
(e) The letter of credit.
(f) Service charges at our local banks.



Form 907 INTEREST

BANK OF MONTREAL

MAIN OFFICE—CORNER PORTAGE AVENUE & MAIN STREET

$

1-3 WINNIPEG, MAN. (BRANCH) Oct 30th 19 Interest $

$

Sixty days after date I promise to pay to the order of Bank of Montreal the sum of One Thousand —— $\frac{00}{100}$ Dollars with interest at the rate of 6 per cent per annum, as well after as before maturity, minimum charge $1 $\frac{00}{100}$, at the Bank of Montreal here. Value received

Arthur Carter

BORROWING MONEY

Arthur Carter, John's older brother, was a salesman in one of the local stores. He wanted a business of his own. But how to get the money was a problem.

"Why not try the bank," asked his father. So Arthur and Mr. Carter had a long talk about the new business with Mr. Hart, the manager of the bank.

"We will lend you $1000 to get started," agreed Mr. Hart, "and will take your **promissory note.**"

1. Read the note.

2. Who signed this note? (He is called the **maker.**)

3. What did Arthur **promise** to do?

4. **When** did he give his written promise (**date of the note**)? **When** must the loan be repaid (**date of maturity**)?

5. How much did Arthur borrow from the Winnipeg Bank? (This is called the **face** of the note.)

6. To whom (**payee**) must the money be repaid?

7. John Carter also read the note. "Why, this is only **a written promise to pay a certain sum of money in a certain time** and signed by the borrower," remarked John. "But what is this item, **with interest at 6%?**" What do you think it means?

8. **"Interest,"** replied Mr. Carter, "is **money paid for the use of money.**" Arthur will use the bank's money in his business. For this right he agrees to pay at the rate of 6% a year. What is the yearly interest on $1000 at 6%?

Find the yearly interest on the following:

	a	*b*	*c*
9.	$600 at 4%	$500 at 3%	$450 at 2%
10.	$7000 at 1%	$750 at 2%	$780 at 4%
11.	$125 at 2%	$100 at $2\frac{1}{2}$%	$1000 at $2\frac{1}{2}$%
12.	$400 at $2\frac{1}{2}$%	$300 at 6%	$920 at 2%
13.	$1000 at 1%	$750 at 5%	$2000 at $1\frac{1}{2}$%

***14.** An interest rate of $\frac{1}{2}$% a month is a rate of what per cent by the year?

LET'S PRACTISE

㉘

	a	*b*	*c*
1.	$9\frac{1}{2} - 7\frac{3}{5} = ?$	$5\frac{1}{4} \times 3\frac{1}{7} = ?$	$6\frac{1}{2} + 4\frac{2}{3} + 9\frac{7}{8} = ?$
2.	$47 \times 6.9 = ?$	$.89 \times 30.6 = ?$	$61.2 \div .17 = ?$
3.	$7 − $3.49 = ?	$.875 \div .07 = ?$	$5\frac{1}{2}$ × $4.38 = ?
4.	18% of 140 = ?	140% of 58 = ?	1.5% of 760 = ?
5.	32 = ? % of 72	110 = ? % of 55	1.4 = ? % of 7
6.	60% of 10,000 = ?	3.5 = ? % of 100	1 = ? % of 1

7. Write as per cents: *a*. $\frac{1}{3}$; *b*. 2; *c*. $\frac{4}{5}$; *d*. .7.

8. Write as decimals: *a*. 4.5%; *b*. 1%; *c*. 110%; *d*. 40%.

FINDING INTEREST

1. Find the interest on $250 at 3% for 2 years.

$$\begin{array}{rl} \$250 & \\ \times .03 & (3\% = .03) \\ \hline \$7.50 & \text{interest for 1 year} \\ \times 2 & \\ \hline \$15.00 & \text{interest for 2 years} \end{array}$$

The sum of money bearing interest is the **principal**; the per cent of the principal that is paid as interest is the **rate**; the number of days, months, or years for which the money is borrowed is the **time**.

2. What is the principal in problem 1? the rate? the time? the interest?

Find the interest in the following examples:

	PRINCIPAL	RATE	TIME		PRINCIPAL	RATE	TIME
3.	$ 400	3%	2 yr.	**9.**	$ 500	4 %	1½ yr.
4.	$ 200	5%	1 yr.	**10.**	$ 150	6 %	½ yr.
5.	$ 800	2%	3 yr.	**11.**	$1000	1½%	2 yr.
6.	$ 300	5%	2½ yr.	**12.**	$ 650	3 %	1 yr.
7.	$1200	2%	1½ yr.	**13.**	$ 725	4 %	2 yr.
8.	$ 550	3%	2 yr.	**14.**	$1250	1 %	1½ yr.

LET'S PRACTISE ㉙

	a	*b*	*c*
1.	$9.6 + 3.7 + 5.9 = ?$	$43.1 - 27.8 = ?$	$11\frac{1}{4} - 9\frac{5}{8} = ?$
2.	$4\frac{2}{3} \times 6\frac{1}{4} = ?$	$\frac{9}{16} \times 2\frac{2}{5} = ?$	$60 \div \frac{5}{6} = ?$
3.	$1\frac{3}{8} \div 11 = ?$	$4\frac{1}{2} \div 3\frac{5}{6} = ?$	$7 \div 8 = ?$
4.	$567 \div 2.7 = ?$	$.576 \div .36 = ?$	$89374 \div 286 = ?$
5.	$7000 - 3549 = ?$	$874 \times 307 = ?$	$9.112 \div .08 = ?$
6.	34 = ? % of 102	50 = ? % of 600	102% of 1500 = ?
7.	1.5% of 96 = ?	18 = ? % of 12	22 = ? % of 25

THE INTEREST FORMULA

1. Refer to any of the interest examples which you worked, page 264.

a. By what did you multiply each principal?

b. By what did you multiply the interest for one year?

2. From this work you get a rule and a formula for finding interest.

RULE: interest = principal × rate × time
FORMULA: $i = p \times r \times t$ or $i = prt$

a. What do you call the formula $i = prt$?

b. Tell what each letter means in the interest formula.

3. Using the interest formula, find the interest on \$400 at 3% for 73 days.

$p = \$400$ $\qquad$ $i = prt$, **the formula**
$r = 3\% = .03$
$t = 73$ **days** $= \frac{1}{5}$ **year** $\qquad$ $i = \$400 \times .03 \times \frac{1}{5} = \$2.40$

Find the interest on the following:

4. \$ 400 at 4% for 73 da.
5. \$ 500 at 4% for 9 mo.
6. \$ 750 at 3% for 4 mo.
7. \$ 200 at 3% for 1½ yr.
8. \$1000 at 4% for 146 da.
9. \$ 450 at 3% for 219 da.
10. \$ 600 at 5% for 73 da.
11. \$ 200 at 6% for 4 mo.
12. \$ 150 at 6% for 292 da.
13. \$ 800 at 2% for 9 mo.
14. \$ 250 at 3% for 146 da.
15. \$1200 at 4% for 5 mo.

USING THE INTEREST FORMULA

In finding interest by use of the formula, the work can be simplified sometimes by setting down the example in the form of a fraction, then reducing.

1. Find the interest on $730 at 4% for 45 days.

$p = \$730$

$r = 4\% = \frac{4}{100}$

$t = 45 \text{ days} = \frac{45}{365} \text{ year}$

$i = prt$, the formula

$i = \$730 \times \frac{4}{100} \times \frac{45}{365}$

$$i = \frac{\overset{2}{\cancel{\$730}} \times \overset{1}{\cancel{4}} \times \overset{9}{\cancel{45}}}{\underset{\underset{5}{\cancel{25}}}{\cancel{100}} \times \underset{1}{\cancel{365}}} = \frac{\$18}{5} = \$3.60$$

The interest is $3.60.

Explain each step in the solution.

Using the method shown, find the interest on the following:

2. $ 365 at 4% for 30 da.
3. $ 600 at 5% for 146 da.
4. $ 730 at 4% for 48 da.
5. $ 900 at 3% for 73 da.
6. $1000 at 2% for 90 da.
7. $ 600 at 3% for 50 da.
8. $150 at 5% for 30 da.
9. $100 at 6% for 45 da.
10. $250 at 6% for 120 da.
11. $500 at 3% for 80 da.
12. $700 at 6% for 40 da.
13. $450 at 6% for 36 da.

LET'S PRACTISE

	a	b	c
1.	$\frac{5}{6} \times \frac{9}{10} = ?$	$4496 \div 78 = ?$	$397 \times 208 = ?$
2.	$41325 - 38196 = ?$	$72 \div \frac{8}{9} = ?$	$14\frac{3}{8} - 9\frac{3}{4} = ?$
3.	$9 \div .16 = ?$	$38 \times 7\frac{3}{4} = ?$	$28 = ?\%$ of 20
4.	$85.4 \times 7.6 = ?$	2.5% of $400 = ?$	$50 = ?\%$ of 80
5.	$4\frac{1}{2} \div 6\frac{3}{4} = ?$	$\frac{7}{8} = ?\%$	$26954 \div 384 = ?$

JOHN CARTER'S SAVINGS

The Bank of Montreal has a **savings** department. John Carter is also a depositor in this department.

John may deposit any sum from one cent up. He may withdraw all or any part of his money at any time by giving two weeks' notice at the bank.

He may draw only a limited number of cheques against his savings without charge; but every six months (**semi-annually**) the bank pays him interest on his deposit.

1. Find the semi-annual interest on the following. The rates are for a year.

a. $100 at 3%
b. $ 75 at 2%
c. $240 at 1%
d. $ 90 at 2%
e. $ 40 at 3%
f. $200 at 1½%
g. $ 50 at 1%
h. $ 60 at 2½%
i. $500 at 1½%

2. Savings account deposits in Canada total about $6,397,000,000. How much is this for each person on the average (estimated population 11,500,000)? for the average family of 4 persons? for your family?

★3. At your nearest bank, inquire about the differences between **current accounts** and **savings accounts.** Discuss, in class, what persons might best use each type of account.

Mr. Carter decided to buy a new tire for the family car. He saw an advertisement of the Central Service Station which read, "New Tires—35% Off."

He knew that he could buy these tires at 35% less than the **marked price.** This reduction is called **discount**, and the price of the tire to Mr. Carter is the **net price** (marked price less discount).

1. If an automobile tire is priced at $14, less 35% discount, what does the tire cost the purchaser?

Marked price, $14	**$14**	**$14.00, Marked price**
Rate of discount, 35%	**×.35**	**4.90, Discount**
	70	**$ 9.10, Net price**
	420	
	$4.90	

a. How much was the saving on the marked price of one tire? of four tires?

b. Why was $14 multiplied by .35?

c. What was the net cost of one tire?

Find the net price of each of the following articles. Marked price and rate of discount are given.

2. Tire, $16, 35%
3. Football, $7.50, 33⅓%
4. Roller skates, $2.50, 20%
5. Book, $1.98, 30%
6. Knife, $1.50, 40%
7. Baseball, $1.25, 20%
8. Bicycle, $34, 30%
9. Sweater, $4.50, 40%
10. Straw hat, $2.50, 50%
11. Tennis racket, $12, 35%
12. Textbook, $3.00, 25%

★13. "A special on graham crackers to-day," said the grocer to Mrs. Carter. "Better stock up!" What inducement to buy was the grocer probably offering his customers?

A SHORT CUT TO THE SELLING PRICE

Here is a shorter way to find the net price when the marked price and rate of discount are given.

1. The marked price of an automobile tire, as you recall (page 268), was \$14 less 35% discount.

If 35% of the regular price is discount,
65% of it is the net price (100% − 35%).
65% = .65

The net price is \$9.10.

$$\begin{array}{r} \$14 \\ \times.65 \\ \hline 70 \\ 840 \\ \hline \$9.10 \end{array}$$

a. What is the difference between this method of working the problem and the method shown on page 268?

b. Which of the two methods do you prefer? Why?

2. If a discount of 15% is offered, the net price is what per cent of the marked price?

3. The net price is what per cent of the marked price when discounts are: *a.* 25%? *b.* 33⅓%? *c.* 40%? *d.* 28%?

Find the net price of each of the following articles (marked price and rate of discount are given). Solve by the "short-cut" method; check by the method given on page 268.

4. Coat, \$12, 30%
5. Cosmetics, \$2.50, 35%
6. Hosiery, \$1.20, 15%
7. Coaster, \$5, 10%
8. Basketball, \$16, 40%
9. Croquet set, \$4, 12½%
10. Golf club, \$3.60, 20%
11. Gladstone bag, \$9.50, 30%
12. Camp stove, \$18, 45%
13. Watch, \$17.50, 15%
14. Bathing suit, \$5.50, 20%
15. Book, \$2.75, 20%

16. If a straw hat is sold at a 50% discount, the discount is what part of the marked price? The net price is what part of the marked price?

WORKING ON COMMISSION

John Carter has a part-time job selling magazines. He gets no fixed pay for his work nor upkeep for his bicycle used in delivering the magazines. Instead of wages and expenses, he is allowed 20% of all money he takes in from his customers. John works **on commission.** His 20% of the sales is his **rate of commission**; the money he keeps, his **commission**; the money he sends to the publishers, the **net proceeds.**

1. If John took in $4.85 from the sale of magazines during one week, what was his commission? the proceeds?

Sales, $4.85
Rate, 20% = .20 = .2

$$\begin{array}{r} \$4.85 \\ \times .2 \\ \hline \$.970 \end{array} \qquad \begin{array}{r} \$4.85 \\ -0.97 \\ \hline \$3.88 \end{array}$$

The commission was $.97. The proceeds were $3.88.

Find the commission and the proceeds on the following:

	Sales	Rate		Sales	Rate		Sales	Rate
2.	$45	15%	9.	$65	25%	16.	$27	40%
3.	$22	30%	10.	$125	10%	17.	$175	10%
4.	$9.60	40%	11.	$64	25%	18.	$740	6%
5.	$760	24%	12.	$2850	6%	19.	$58	25%
6.	$1350	2%	13.	$920	15%	20.	$114	15%
7.	$680	5%	14.	$1500	7%	21.	$1450	2%
8.	$5800	3%	15.	$10,000	2½%	22.	$1675	5%

23. A real estate agent sold a house for \$6500 at a 5% commission. How much was his commission?

24. An architect charged a commission of 6% on the cost of erecting a school building. If the cost of the building was \$265,000, what was the architect's commission?

***25.** An agent earned \$30 a week from sales that amounted to \$75. What was his rate of commission?

***26.** Find the rate of commission on the following: *a.* commission \$15, sales \$180; *b.* commission \$2.50, sales \$7.50; *c.* commission \$36, sales \$180.

***27.** Select any two of the following topics for brief reports to your class:

a. Under what conditions would you rather work on commission than on a fixed salary?

b. List 10 articles commonly sold on commission.

c. Why is the rate of commission higher on some articles than on others?

d. Some sales persons work on "straight commission"; others, on "salary plus commission." How do these two methods of pay differ?

e. Why do some stores pay their sales clerks a commission rather than a fixed salary?

f. John knew a man who received 40% commission on the sale of brushes, and another who received 20% commission on the sale of aluminum ware. He wondered if the first man earned twice as much as the second. What do you think?

LET'S PRACTISE

	a	*b*	*c*
1.	$15 \div \frac{3}{4} = ?$	$15\frac{1}{8} - 9\frac{3}{4} = ?$	$45 \div .5 = ?$
2.	$408 \times 36 = ?$	$.105 - .090 = ?$	$5\frac{3}{4} \times 3\frac{1}{3} = ?$
3.	4% of 320 = ?	15 = ? % of 25	1.5% of 180 = ?
4.	$\frac{3}{8}$ = ? %	220% of 40 = ?	60 = ? % of 40

5. \$9.46 + \$1.58 + \$.49 + \$34.50 + \$19.75 + \$.98 = ?

HOW WELL DO YOU REMEMBER?

1. Coal which usually sells at \$14.75 a ton was on sale at \$13.50 a ton. How much would be saved by buying 12 tons of coal at the sale price?

2. A dealer sold a truck that cost him \$1,800 at a discount of 20%. What was the selling price?

3. An airplane recently flew at the rate of 268.38 miles an hour. How many miles a minute was this?

4. How many minutes longer than 8 periods of $\frac{3}{4}$ of an hour each are 7 periods of 55 minutes each?

5. Find the interest on \$250 for $2\frac{1}{2}$ years at 4%.

6. A dairy farm sold the following quantities of milk during the month of August: first week, 4,010 pounds; second week, 3,750 pounds; third week, 3,990 pounds; fourth week, 3,800 pounds. How much was received for the milk at \$2.40 a hundred pounds?

7. A real estate agent sold a house for \$7,500. If his commission is 4% on the first \$1,000 and 3% on the balance, what is his total commission?

8. Martin used 8 gallons of gasoline in making an automobile trip of 100 miles. Find the cost of the gasoline per mile if the gasoline cost 35¢ a gallon.

9. The clothing in a men's furnishings store was valued at \$5,400. After being damaged by fire, the stock of clothing was valued at \$4,050. What was the per cent of loss?

10. A man borrowed \$850 for 90 days at 6%. How much did he owe at the end of the 90 days?

11. In problem **9**, what is the ratio of the value of the stock after the fire to the value before the fire? Express your result as a fraction; as a decimal; as a per cent.

THE CARTER SPORTS SHOP

John Carter often visited his brother Arthur's sporting goods store to see how the new business was coming along.

One day John picked up a baseball bat marked $1. "How much did this bat cost?" asked John.

"60¢," replied Arthur.

"That means 40¢ profit on each $1 bat sold; not bad!" remarked John.

"Not all profit, you mean. See that price tag? I bought it and pasted it on the bat. Price tags are only one expense of operating this business. There are dozens of others.

"The 60¢ I paid for that bat is the **wholesale** price; $1 is the **retail** price; the **difference,** 40¢, is my **gross profit** or **margin.** Out of margin I must pay all my expenses; and what is left, if anything, is my profit."

1. Write a rule for finding the margin. Change the rule to a formula.

2. Given the margin, write a rule for finding profit. Change the rule to a formula.

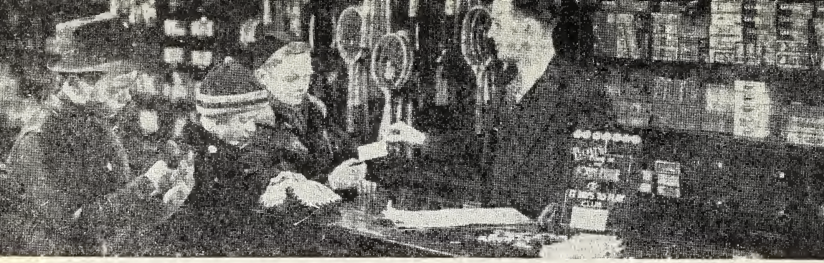
3. The cost of the baseball bat was what per cent of its selling price?

4. The margin on the bat was what per cent of the selling price?

Find the margin in the following:

	Selling Price	Cost		Selling Price	Cost		Selling Price	Cost
5.	$1.25	$0.78	8.	$2.39	$1.87	11.	$2.15	$1.88
6.	$0.54	$0.35	9.	$1.19	$0.86	12.	$1.98	$1.50
7.	$3.75	$2.98	10.	$4.35	$3.49	13.	$0.75	$0.48

14. If the cost of a pair of ice skates is $2.35 and the margin is 85¢, what is the selling price?



PROFIT AND LOSS

1. Name 10 expenses incurred by Arthur Carter in the operation of his sporting goods store.

2. Arthur sold on **credit** as well as for cash. He let customers have goods on promise to pay later. Some never paid. How did these outstanding bills affect his profits?

3. If Arthur can find ways to reduce his expenses, how will such reduction affect his profits?

4. Arthur sold a first baseman's mitt, which cost him 90¢, for $1 because it was the last of its kind on hand. He estimated his expenses on this sale at 18¢. Did he gain or lose? How much? What per cent did he lose on the cost of the mitt?

Find the profit or loss on the following:

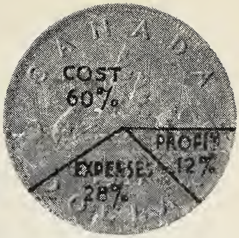
	Selling Price	Cost	Expenses		Selling Price	Cost	Expenses
5.	$325	$216	$48	10.	$175	$142	$29
6.	$149	$98	$56	11.	$360	$279	$64
7.	$510	$432	$64	12.	$440	$380	$67
8.	$275	$214	$37	13.	$872	$695	$143
9.	$110	$73	$28	14.	$225	$146	$58

15. A suit, marked to sell at $35, was discounted 20%. What was the selling price?

16. If the suit cost $22.50, what was the margin?

*17. If the margin remains the same, what happens to the profit as the expenses increase? decrease?

THE SALES DOLLAR



Each dollar that Arthur Carter, or any other merchant, receives from the sale of goods is his **sales dollar.** It includes, as you have learned, cost and margin. Margin includes expense and profit. The circle graph shows how the sales dollar is divided in the Carter sporting goods business.

1. What per cent of the sales dollar is cost? expense? profit? margin?

2. John said, "The cost of an article in Arthur's store is about $\frac{3}{5}$ of the selling price, and the margin is $\frac{2}{5}$." How nearly correct was he?

3. Find the cost, expense, and profit on sales for one week amounting to $560. Use the rates shown in the graph.

4. Find the missing amounts in the following table:

	Sales	Cost		Expense		Profit	
		%	$	%	$	%	$
a.	$350	60	?	25	?	15	?
b.	$765	70	?	25	?	5	?
c.	$108	56	?	32	?	12	?
d.	$1150	68	?	24	?	8	?
e.	$2075	55	?	35	?	10	?
f.	$990	75	?	20	?	5	?
g.	$2550	65	?	26	?	9	?
h.	$1820	63	?	29	?	8	?
i.	$1540	68	?	25	?	7	?

★5. If Arthur Carter bought merchandise for $388 and sold it for $476, and his expenses were 28% of his sales, did he gain or lose on the transaction, and how much?

TRADE DISCOUNT

Arthur Carter buys sporting goods from a **wholesale** dealer; that is, a merchant who sells only in large quantities at a time and usually to other merchants.

The wholesaler hands Arthur a catalogue (in which each article is described and priced) with the remark, "40% off the list as usual."

This tells Arthur that he may buy any article in the catalogue at 40% less than it is marked. "Trade discount," the dealer calls the reduction, because it is the usual or customary allowance in the sporting goods trade.

1. A fishing rod was listed in the catalogue at $10.00. What was the net cost of the rod to Arthur?

Marked price = $10.00
Discount = 40% = .40 = .4

$$\begin{array}{r} \$10.00 \\ \times .4 \\ \hline \$4.000 \end{array} \qquad \begin{array}{r} \$10.00 \\ -4.00 \\ \hline \$\ 6.00 \end{array}$$

The discount was $4.00. The net cost was $6.00.

2. If Arthur sells the rod at the marked price, what is his margin?

3. A manufacturer of automobiles gives his dealers a trade discount of 24% of the marked price. Find the net cost to the dealer of a car marked at $765; at $980.

Find the net cost of the following purchases:

	MARKED PRICE	TRADE DISCOUNT		MARKED PRICE	TRADE DISCOUNT		MARKED PRICE	TRADE DISCOUNT
4.	$4.80	30%	10.	$16.80	25%	16.	$38	24 %
5.	$38	28%	11.	$76	34%	17.	$18.75	33⅓%
6.	$148	35%	12.	$155	32%	18.	$375	25%
7.	$355	38%	13.	$540	38%	19.	$16.50	50%
8.	$650	26%	14.	$925	45%	20.	$25.50	20%
9.	$840	33⅓%	15.	$790	36%	21.	$745	35%

LET'S PRACTISE

1. $\begin{array}{r} .745 \\ .358 \\ .100 \\ .950 \\ .675 \\ \hline \end{array}$

2. $\begin{array}{r} 9\frac{1}{2} \\ -4\frac{7}{8} \\ \hline \end{array}$

3. $\begin{array}{r} 46 \\ \times 3.6 \\ \hline \end{array}$

4. $5\frac{1}{2} \times 6\frac{2}{3} = ?$

5. $36 \div \frac{3}{4} = ?$

6. $.16\overline{)11}$

7. $\begin{array}{r} 5\frac{1}{2} \\ 2\frac{3}{4} \\ 1\frac{7}{8} \\ 4\frac{1}{4} \\ \hline \end{array}$

8. $\begin{array}{r} 15.30 \\ -8.75 \\ \hline \end{array}$

9. $25\overline{)4}$

10. $8\frac{1}{2} \div 1\frac{1}{6} = ?$

11. $\begin{array}{r} 7.8 \\ \times .05 \\ \hline \end{array}$

12. 6% of 85 = ? 13. 1.5% of 640 = ? 14. 250% of 24 = ?
15. 7 = ? % of 21 16. 30 = ? % of 25 17. 28 = ? % of 70
18. Change to decimals: *a* 5.5%; *b*. 125%; *c*. $12\frac{1}{2}$%.
19. Write as per cents: *a*. .015; *b*. $\frac{3}{4}$; *c*. 2; *d*. 1.4.

INFORMATION PLEASE!

1. What is the largest number that may be written with five figures? What is the next number?

2. There are how many thousandths in .6?

3. If three fourths of a number is 60, what is the number?

4. The circumference of a circle is how many times greater than its diameter?

5. What means of communication have been invented since 1930?

6. There are how many sides to a hexagon?

7. How many triangles may be formed by drawing diagonals from any one vertex of a hexagon?

8. A line, $2\frac{1}{4}$ inches long, is bisected. What is the length of each part?

9. There are how many degrees in the sum of the angles of a rectangle?

10. What is the meaning of the word **kilo?**

FINDING THE SELLING PRICE

Arthur Carter finds that the expenses of his sporting goods store average about 28% of the cost of the merchandise; his profits, 12%.

1. If he buys a tennis racket for $7.50, at what price should he sell it?

Copy and complete the following work.

12% = .12 × $7.50 = ? (desired profit)
28% = .28 × $7.50 = ? (to cover expense)
$7.50 + ? (profit) + ? (expense) = ? (the selling price)

2. The margin on the racket was what per cent of the cost? of the selling price?

3. Tony Maletesta operates a green grocery. His expenses are 50% of the cost of the produce, and his profit is 9%. Find the selling price of vegetables which cost $7.20.

Find the selling price of the following:

	Cost	Expense	Profit		Cost	Expense	Profit
4.	$4	40%	10%	9.	$20	32%	14%
5.	$9	30%	16%	10.	$38	35%	10%
6.	$27	33⅓%	10%	11.	$92	37%	12%
7.	$225	28%	14%	12.	$340	34%	18%
8.	$560	24%	15%	13.	$795	35%	14%

14. The cost of goods was $78. If the profit was 12% of the cost, and the expense 28% of the cost, what was the selling price?

Tom reasoned as follows, "If the profit is 12% of the cost, and the expense 28%, the margin is 40%. As cost plus margin equals selling price, the selling price is 140% of the cost, or 1.4 × $78 = $109.20." Check Tom's work.

PROFIT BASED ON SELLING PRICE

Arthur Carter figured his profit on the **cost** of goods **to him.** He might have figured his profit on the **cost** of the goods **to his customers**; that is, profit (and, of course, expense and margin) can be based on **cost** or on **selling price.**

1. Suppose, for example, that Arthur Carter sold sporting goods in one week amounting to $430. If his expenses were 28% of his sales, and his profit 12%, how much was expense? profit? cost of goods sold?

Selling price, $430	**.28 × $430 = $120.40, expense**
Expense, 28% of S.P.	**.12 × $430 = $51.60, profit**
Profit, 12% of S.P.	**$120.40 + $51.60 = $172.00, margin**
(S.P. = selling price)	**$430 − $172.00 = $258.00, cost**

2. Arthur's margin was what per cent of his sales?

3. The cost of goods sold (problem 1) was what per cent of the selling price?

4. Mrs. Kelly has a candy shop. She estimates her expenses at 30% of her sales, and her profit at 12%. On sales amounting to $36, how much represents profit? expense? the cost of goods sold? Show this by a circle graph.

In the following examples, find how much the merchant paid for each article sold; his expense; and his profit.

	Selling Price	Expense	Profit
5.	$14	25%	12%
6.	$87	26%	11%
7.	$165	35%	8%
8.	$720	33⅓%	12½%
9	$38	27%	12%
10	$95	32%	9%
11.	$346	24%	8½%
12.	$510	29%	3½%

TAKING AN INVENTORY

Once each year Arthur took **account of stock**. With the help of his father and John, he counted every article in the store. Then he prepared an **inventory**, one sheet of which is shown below.

December 31, 19—

Article	Number of Articles	Cost per Article	
Badminton sets	2	12	35
Baseballs, official size	20	1	85
Baseballs, night balls	40	2	00
Baseball bats, league	6	2	65
Baseball bats, school	9		35
Basketballs	2	9	25
Basketball shoes, size 10	8	7	65
Basketball shoes, size 12	14	7	65
Footballs, yellow leather	12	10	00
Football helmets	5	13	75
Hockey sticks	9	3	75

1. Figure the cost of each item of stock on hand; of all the items listed.

2. *a*. Find from your dictionary a definition of **inventory**.

b. Take an inventory of items in your room at home.

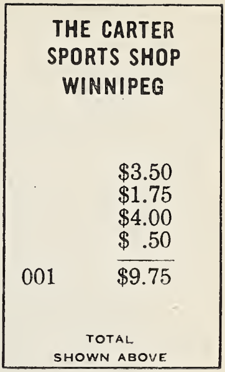
*3. During the year Arthur had purchased 40 hockey sticks. How many had he December 31? How many had he sold?

*4. During the year Arthur had paid $10,000 for sporting goods. At the end of the year his stock of goods on hand was valued at $1500. What was the cost of the goods which he had sold?

*5. If Arthur took in $12,500 during his first year of business, what was his margin? (HINT: sales – cost of goods sold.)

*6. If Arthur's expenses of doing business were $3500. how much profit did he earn?

BILLS AND RECEIPTS



THE CARTER
SPORTS SHOP
WINNIPEG

$3.50
$1.75
$4.00
$ .50

001 $9.75

TOTAL
SHOWN ABOVE

The Carter sports shop, as you recall, sold on credit as well as for cash.

1. When a cash sale was made, the items were "rung up" on the cash register and a receipt handed to the customer. How many items were sold? What was the price of each? the total sale?

2. When goods were sold on credit, a sales slip was made out, one copy handed to the customer, and the other copies retained by the store.

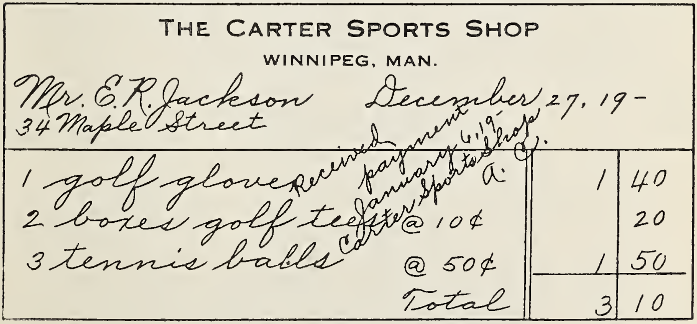
a. To whom were the goods sold? by whom? when?

b. Check the amount charged for each item on the bill; its total. Do you find this bill correct? Why or why not?

c. Has this bill been paid? How do you know?

d. What was the date of the receipt?

3. When Mr. Jackson paid his bill, January 6, Arthur put the money in the cash drawer and promptly forgot the transaction. On the first of the following month Mr. Jackson received a duplicate bill. How will he prove payment?



THE CARTER SPORTS SHOP
WINNIPEG, MAN.

Mr. E. R. Jackson December 27, 19–
34 Maple Street

1 golf glove	1	40
2 boxes golf tees @ 10¢		20
3 tennis balls @ 50¢	1	50
Total	3	10

Received payment January 6, 19–
Carter Sports Shop
A. C.

MAKING AND RECEIPTING BILLS

Rule bill forms and make out bills for the following items. Supply names and dates.

1. Purchases at a grocery store: 1 lb. coffee, 45¢; 2 boxes raisins @ 11¢; 5 lb. sugar @ 9¢; 10 lb. potatoes @ $2\frac{1}{2}$¢; 1 doz. bananas, 60¢; 3 cans of soup @ 8¢.

2. Purchases at a sporting goods store: 3 tennis balls, 89¢; 1 tennis racket, $5.95; 1 golf club, $2.45; 3 golf balls @ 35¢; 1 box of golf tees, 18¢; 1 sport shirt, 98¢.

3. Purchases at a drugstore: 1 tube tooth paste, 39¢; 1 prescription filled, $1.25; 2 boxes paper tissue @ 14¢; 1 doz. aspirin tablets, 15¢; 3 chocolate bars @ 8¢; 1 package razor blades, 23¢.

4. Purchases at a general retail store: 3 yd. gingham @ 45¢; 1 roasting pan, $1.38; 18 yd. cheesecloth @ $1\frac{1}{2}$¢; 2 union suits @ $1.19; 1 dress, $4.95.

5. Receipt each of the bills.

6. Mr. Tracy received a bill from the Fuel Oil Supply Company for 1120 gallons of fuel oil at 13¢ a gallon. A discount of 5% was allowed for payment within 10 days. To the nearest cent, what was the cash price of the fuel oil?

*7. Bring to class some receipted bills. Was a discount allowed on any of them for a cash payment?

LET'S PRACTISE

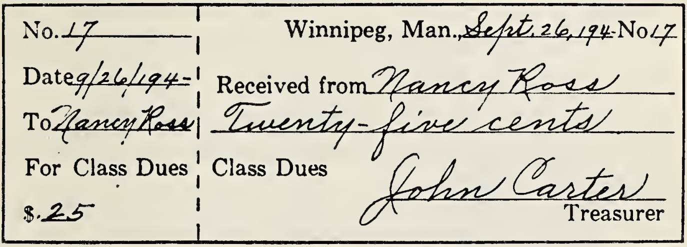
	a	b	c
1.	$17 \times 87 = ?$	$3.9 \times 9.5 = ?$	$9\frac{1}{4} - 4\frac{2}{3} = ?$
2.	$96 \div \frac{3}{4} = ?$	$1596 \div 38 = ?$	$8.792 \div 31.4 = ?$
3.	$504 \times 609 = ?$	$\frac{3}{4} \div \frac{9}{10} = ?$	$14\frac{1}{6} - 5\frac{3}{4} = ?$

4. Add: $708 + 309 + 502 + 800 + 906 + 405 = ?$

5. How much greater is 9 ft. 3 in. than 4 ft. 8 in.?

RECEIPT FORMS

John Carter was treasurer of his class. He collected dues from his classmates and gave each of them a **receipt.** Note that a **stub** is attached to the receipt blank. John retains this stub as his record.



No. 17
Date 9/26/194-
To Nancy Ross
For Class Dues
$.25

Winnipeg, Man., Sept. 26, 194- No 17
Received from Nancy Ross
Twenty-five cents
Class Dues John Carter
Treasurer

The Stub *The Receipt*

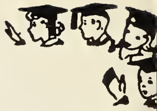
1. How does a receipt differ from a cheque?
2. What is the purpose of filling in the stub?
3. What items are shown on the receipt?
4. When is a receipt usually given?

USING THE VOCABULARY OF ARITHMETIC

Define, or use in a sentence, each of the following terms:

budget	(240)	inventory	(280)
cancelled cheque	(259)	margin	(273)
cheque stub	(258)	marked price	(268)
commission	(270)	net price	(268)
deposit slip	(257)	postal money order	(260)
discount	(268)	principal	(264)
endorse	(258)	sales dollar	(275)
interest	(263)	savings dept.	(267)
interest formula	(265)	trade discount	(276)

HOW WELL DO YOU REMEMBER?



1. Name five services provided by banks.

2. Tell some of the things to observe when writing a cheque.

3. What is the difference between a deposit slip and a cheque?

4. A cheque was made out to A. C. Martin. Before he can cash this cheque what must he do?

5. Give some of the advantages of using cheques.

6. Name several ways of sending money safely. Describe briefly each method.

7. Clayton borrowed $25 from his brother at 5% interest. What was the yearly interest on the loan?

8. Use the interest formula and find the interest on the following:

a. $800 for 60 days at 4%
b. $560 for 3 months at 6%
c. $450 for 6 months at 5%
d. $200 for 90 days at 6%
e. $550 for 6 months at 2%
f. $150 for 60 days at 6%

9. Show that the interest on any principal, such as $100, is the same when the rate is 4% for 1 year or when the rate is 2% for 2 years.

10. Find the commission on the following:

Sales	Rate	Sales	Rate	Sales	Rate
a. $125	15%	*c*. $306	12%	*e*. $190	25%
b. $960	8%	*d*. $3675	6%	*f*. $360	5%

11. Find the net price on the following articles:

Article	Marked Price	Discount	Article	Marked Price	Discount
a. Tennis racket	$12	$33\frac{1}{3}$%	*d*. Bicycle	$35	25%
b. Rifle	$18	30%	*e*. Auto tire	$14.50	20%
c. Suit	$32	15%	*f*. Coaster	$6.25	20%

12. A retail store received a shipment of merchandise marked at $375. If a trade discount of 35% was allowed, what was the net cost of the goods?

13. A merchant ordered goods marked at $100, less 40% trade discount. If he sold the goods at the marked price, what was his margin? The margin was what per cent of the cost? of the selling price?

14. Find the profit or loss on the following:

	Selling Price	Cost	Expense		Selling Price	Cost	Expense
a.	$45	$28	$9	*e.*	$125	$92	$28
b.	$325	$276	$54	*f.*	$460	$387	$56
c.	$627	$540	$193	*g.*	$750	$532	$146
d.	$548	$399	$137	*h.*	$610	$487	$134

15. Find the selling price when the expense and the profit are expressed as a per cent of the cost.

	Cost	Expense	Profit		Cost	Expense	Profit
a.	$38	30%	14%	*c.*	$57	33%	15%
b.	$125	28%	12%	*d.*	$240	36%	6%

16. Find the cost when the expense and profit are expressed as a per cent of the selling price.

	Selling Price	Expense	Profit		Selling Price	Expense	Profit
a.	$60	24%	9%	*c.*	$45	28%	10%
b.	$145	26%	12%	*d.*	$325	27%	8%

17. Show how a merchant may sell an article for more than cost and yet have a loss on the transaction.

18. Rule a form and make a bill for the following items. Supply names and dates.

2¼ lb. steak @ 40¢; ½ lb. bacon @ 45¢; 1½ lb. lamb chops @ 36¢; 3½ lb. chicken @ 28¢.

PER CENT AND ITS APPLICATIONS

Set I. Find the missing amounts:

1. 4 is ? % of 40
2. 20 is ? % of 5
3. 15 is ? % of 50
4. 9 is ? % of 9
5. 12 is ? % of 18
6. 36 is ? % of 48
7. 50 is ? % of 20
8. 1 is ? % of 100
9. 1% of 100
10. 25% of 420
11. 33⅓% of 960
12. 100% of 7.8

Set II. Find the net cost of the following:

	Marked Price	Discount
1.	$40	15%
2.	$54	28%
3.	$120	35%
4.	$450	37.5%
5.	$625	32%
6.	$32	12%
7.	$76	25%
8.	$110	33⅓%
9.	$265	27%
10.	$1220	24%

Set III. Find the cost of goods sold and the margin. (Expense and profit are expressed as a per cent of the selling price.)

	Selling Price	Cost	Expense	Profit	Margin
1.	$150	?	25%	8%	?
2.	$85	?	30%	9%	?
3.	$430	?	28%	11%	?
4.	$565	?	24%	12%	?
5.	$728	?	29%	9%	?

Set IV. Find the selling price. (Expense and profit are expressed as a per cent of the cost.)

	Cost	Expense	Profit
1.	$27	27%	14%
2.	$98	37%	16%
3.	$328	39%	14%
4.	$405	40%	18%
5.	$59	31%	17%
6.	$146	40%	15%
7.	$524	37%	20%
8.	$975	28%	19%

THINGS TO REMEMBER

1. *Some forms used by banks.*
2. *What the formula is for finding interest.*
3. *What discount is and when it is given.*
4. *How to price goods.*
5. *How to bill a customer for his purchases.*

TEST ON CHAPTER IX

1. What is the difference between cashing a cheque and depositing it?

2. Mr. Smith, in Toronto, sent to his son, in Regina, a cheque by air mail. What quicker means could he have used to send the money? Which of the two ways is the cheaper?

3. What is the purpose of an inventory?

4. The sales dollar of a certain store is divided as follows: cost, 60%; expense, 32%; profit, 8%. Show these amounts by a circle graph.

5. If the sales (problem 4) amount to $730, find the cost, expense, profit.

6. State two things which affect an agent's earnings when he is working on a commission.

7. Name some items which are included in a merchant's expenses.

8. How does expense affect profit?

9. Goods sold for $72. If the expense was 30% of the selling price, and the profit 8%, find the cost of goods sold.

10. Margin may be expressed as a per cent of either of two amounts. What are they?

PROGRESS TEST IN PROBLEM SOLVING

Solve the following problems. Then have your paper scored. If you had trouble with any problem, turn to the key page in parentheses where the work is explained.

1. If an airplane travels 144 miles in $\frac{3}{4}$ hour, what is the rate of the plane in miles an hour? (58)

2. The land area of Canada is 3,694,863 square miles. Round off this number to the nearest ten thousand square miles. (29)

3. If a batter gets 3 hits out of 10 times at bat, is he a "300 hitter"? (80)

4. A farmer was told that by using a better grade of fertilizer he could increase the yield of his wheat crop 25%. If he now gets 18 bushels from an acre, how many bushels could he get by changing to the better grade of fertilizer? (130)

5. A telegram cost 80¢ plus a tax of 5%. What was the amount of the tax? (130)

6. When a map is drawn to a scale, 1 in. = 10 mi., what is the distance between two cities that are $4\frac{1}{2}$ inches apart on the map? (160)

7. Find the area of a triangle having a base of 18 feet and an altitude of 15 feet. (205)

8. When the price of a dozen oranges increases from 30¢ to 35¢, what is the per cent increase? (141)

9. If the side of a regular hexagon is 1.5 feet, what is its perimeter? (168)

10. Mr. Harris used 1920 gallons of fuel oil a year. If the heating power of 140 gallons of fuel oil is equal to one ton of coal, how much coal would he need to produce the same amount of heat? (22)

TO A NEW GRADE

TABLES FOR REFERENCE

Counting

12 things = 1 dozen
12 dozen = 1 gross
20 things = 1 score

Liquid Measure

2½ cups = 1 pint
2 pints }
5 cups } = 1 quart
4 quarts = 1 gallon

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel

Time Measure

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
365 days = 1 year
366 days = 1 leap year

Cooking

3 teaspoons = 1 tablespoon
16 tablespoons = 1 cup
2½ cups = 1 pint

Avoirdupois Weight

16 ounces = 1 pound
100 pounds = 1 hundred-weight (cwt.)
2000 pounds }
or } = 1 ton
20 cwt. }
2240 pounds = 1 long ton

Troy Weight

(For jewels and precious metals)
24 grains = 1 pennyweight (pwt.)
20 pwt. = 1 ounce
12 ounces = 1 pound
5760 grains = 1 pound (Troy)
7000 grains = 1 pound (Avoirdupois)

Length

12 inches = 1 foot
3 feet = 1 yard
16½ feet }
or } = 1 rod
5½ yards }
4 inches = 1 hand
6 feet = 1 fathom

5280 feet }
or }
1760 yards } = 1 mile
or }
320 rods }

1.15 statute miles = 1 nautical mile

Surface or Square Measure

144 square inches = 1 square foot
9 square feet = 1 square yard
160 square rods }
or } = 1 acre
43,560 square feet }
640 acres = 1 square mile or 1 section
36 sections = 1 township

REMEDIAL EXERCISES

Table of Addition and Subtraction Facts

To find an addition combination, such as 3 + 8, find **3** in the column on the left. With your finger trace along the row containing **3** until you come to the column which has **8** at the top. The sum of 3 + 8, or 11, is in that square.

To find a subtraction combination, such as 12 − 5, find **5** in the column at the left. With your finger trace along the row containing **5** until you come to 12. The number at the top of this column is the answer to the fact 12 − 5, or **7**.

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Table of Multiplication and Division Facts

The products are found by multiplying the numbers at the top of the columns by each number at the left margin.

If each product is divided by the number in its row on the left margin, the quotient will be the number at the top of the column in which the product is found.

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

Addition of Whole Numbers and Denominate Numbers

I.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*	*o*	*p*
	3	1	9	5	2	1	6	1	3	2	9	3	5	1	5	4
	4	6	2	3	1	5	2	1	5	4	8	8	6	7	1	4
	8	7	4	8	4	4	8	4	7	5	7	7	4	9	8	8
	5	4	1	4	8	7	9	8	8	7	6	2	9	6	3	9

II.	1	2	6	5	2	3	8	1	5	7	6	8	4	5	7	5
	4	5	3	4	7	8	0	6	2	6	9	4	3	8	7	9
	6	4	7	7	6	4	4	7	4	0	4	9	7	4	8	3
	7	9	1	6	5	5	3	8	1	8	1	0	6	0	8	8
	3	1	8	3	1	9	9	5	8	9	5	2	1	3	9	4
	5	8	4	8	9	6	2	1	7	3	4	7	2	9	9	9

III.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
	31	23	48	59	71	18	39	60	22	90	16	74
	47	46	28	19	16	24	25	27	34	20	29	98
	62	50	90	70	32	93	40	45	67	78	38	53
	54	79	56	38	54	55	18	32	45	47	74	69
	19	42	37	54	96	80	93	86	68	35	83	14
	38	81	89	12	87	74	59	29	75	64	32	35

IV.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	35	70	94	60	408	54	503	78	59	504	304
	28	20	38	70	103	77	906	20	72	608	409
	56	40	57	80	506	28	802	48	48	703	103
	19	30	16	40	702	96	705	34	30	905	506
	80	90	20	90	809	40	604	27	81	108	302
	42	80	35	50	104	55	308	53	70	207	409

V.

a	b	c	d	e	f	g	h	i
431	28	54	1528	4548	135	35	$37.24	$13.85
96	190	8	1749	393	458	1428	9.58	24.06
827	72	325	367	56	97	957	0.39	7.38
329	435	109	945	6090	965	4214	14.98	6.50
106	97	68	59	271	420	386	7.25	9.25
97	106	37	746	584	908	805	6.49	42.18

VI.

	a		b		c		d		e	
1.	qt.	pt.	bu.	pk.	ft.	in.	da.	hr.	yd.	ft.
	4	1	8	1	7	3	2	12	5	1
	3	1	5	3	4	6	4	6	3	2
	5	1	2	2	3	8	1	15	6	2
2.	qt.	pt.	bu.	pk.	ft.	in.	da.	hr.	yd.	ft.
	4	1	15	3	9	10	1	20	5	2
	2	1	24	2	4	8	4	22	1	2
	5	1	35	3	7	9	3	18	8	2

Subtraction of Whole Numbers and Denominate Numbers

I.

	a	b	c	d	e	f	g	h	i	j
1.	471	546	832	965	652	791	573	857	962	420
	238	229	417	438	139	436	129	328	436	136
2.	643	942	490	744	548	856	645	945	444	754
	128	317	168	217	129	328	127	139	126	438

II.

1.	718	305	854	913	639	437	846	432	544	968
	145	142	372	421	285	185	251	160	184	188

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
2.	629	786	568	705	937	459	855	906	746	729
	485	194	281	382	175	186	295	152	373	138

III.

1.	541	723	960	483	624	711	834	546	733	812
	268	154	165	196	496	129	158	198	166	195
2.	724	546	927	720	525	738	635	810	742	537
	389	458	839	481	496	149	449	379	687	168

IV.

1.	502	601	802	801	707	604	902	705	802	508
	138	428	405	409	519	308	458	356	193	389
2.	604	906	707	603	501	801	502	605	805	706
	189	308	518	496	123	402	304	427	309	237

V.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	6000	7000	9000	3000	8000	6000	5000	4000
	2312	1404	2001	2045	1080	3212	1404	2083
2.	9000	6000	5200	7100	3001	8010	4000	5000
	1723	1406	3209	6105	2005	4007	1001	3089

VI.

1.	7352	4012	6004	1000	2004	9301	6006	302
	68	395	35	524	59	725	97	8
2.	8112	3012	5240	9630	7321	1005	7012	605
	59	46	743	108	392	48	107	9

VII.	a		b		c		d			
1.	bu.	pk.	ft.	in.	da.	hr.	qt.	pt.	yd.	ft.
	8	2	9	4	4	12	7		4	1
	5	3	5	8	2	16	3	1	2	2
2.	bu.	pk.	ft.	in.	da.	hr.	qt.	pt.	yd.	ft.
	15	1	14	2½	8	9¾	5		11	1½
	7	3	12	3¼	5	7½	2	1½	8	2½

Multiplication of Whole Numbers and Denominate Numbers

I.	a	b	c	d	e	f	g	h	i
1.	54	96	39	642	387	615	750	968	735
	9	7	8	5	4	8	3	8	6
2.	948	385	740	784	950	541	672	4239	8599
	7	9	8	6	6	9	8	6	8

II.									
1.	408	305	706	901	603	608	109	4007	5003
	7	5	8	7	2	9	8	4	3
2.	903	609	702	104	508	6007	3001	7002	5008
	8	4	3	9	7	8	9	5	8

III.	a	b	c	d	e	f	g	h	i	j
1.	56	49	78	95	84	935	625	756	831	925
	38	23	21	46	29	48	18	59	96	38
2.	79	36	69	71	98	457	839	526	348	849
	14	36	58	49	25	93	67	72	61	86

IV.

	a	b	c	d	e	f	g	h	i
1.	308 25	602 19	570 54	320 29	340 46	709 58	507 69	802 91	5800 37
2.	109 84	306 72	940 38	701 81	380 38	605 85	706 54	309 28	9600 34
3.	101 24	705 45	901 91	607 94	680 75	150 96	302 49	590 27	6700 85

V.

1.	324 156	738 251	945 168	352 504	960 208	375 415	789 229	460 105	730 703
2.	508 205	960 403	550 205	732 146	983 376	524 189	913 319	275 109	917 107
3.	306 108	870 206	590 431	854 139	729 406	311 201	754 295	836 149	841 409

VI.

1.	580 30	960 70	723 400	536 900	680 470	390 700	5001 400	9002 304	6003 209
2.	790 500	380 260	450 450	760 800	930 600	803 405	9006 208	5001 704	8003 600
3.	620 120	900 800	500 700	630 700	803 504	690 780	1004 309	7000 300	5000 800

VII.

	a	b	c	d	e
1	ft. in 6 3 × 4	gal. qt. 2 3 × 4	bu. pk. 8 3 × 4	yd. ft. 6 2 × 3	qt. pt. 4 1 × 3

	a	b	c	d	e
2.	ft. in. 9 8 × 5	gal. qt. 7 1 × 3	bu. pk. 15 2 × 5	yd. ft. 5 1 × 4	qt. pt. 8 1 × 5
3.	ft. in. 7 5 × 3	gal. qt. 12 3 × 2	bu. pk. 8 3 × 6	yd. ft. 9 2 × 7	qt. pt. 12 1 × 9

Division of Whole Numbers and Mixed Numbers With a One-figure Divisor

	a	b	c	d	e	f
I. 1.	5)372	3)748	4)853	3)2050	4)3498	6)1354
2.	6)2246	6)4716	6)4628	7)789	7)6518	8)7374
3.	8)5864	9)7578	9)8469	9)5688	9)1198	9)4869
4.	9)6786	8)6847	7)5964	3)2378	5)4457	6)3956
II. 1.	4)816	6)2106	6)2640	7)2809	7)5615	8)2436
2.	6)1813	7)1419	9)6390	8)5636	9)6480	5)4109
3.	9)8100	8)3600	7)4914	6)1626	8)5632	7)5600
III. 1.	6)3425	7)2414	7)711	6)1145	7)1429	8)5843
2.	7)3225	6)3902	8)7283	5)3040	4)9260	3)2642
3.	8)6565	9)6666	7)5044	6)5645	5)7203	9)7658
IV. 1.	7)5529	8)5260	8)7054	8)1283	7)6148	7)2329
2.	9)2074	8)2154	8)5130	6)5163	7)5182	9)1150
3.	6)4040	4)1074	7)4000	9)2112	9)3121	8)5002
4.	8)7955	7)2000	6)4121	8)6132	9)7018	7)3426

V.	*a*	*b*	*c*
1.	$3\overline{)6\text{ hr. }30\text{ min.}}$	$3\overline{)8\text{ qt. }1\text{ pt.}}$	$2\overline{)6\text{ gal. }3\text{ qt.}}$
2.	$2\overline{)15\text{ ft. }6\text{ in.}}$	$3\overline{)9\text{ ft. }4\text{ in.}}$	$3\overline{)8\text{ bu. }1\text{ pk.}}$
3.	$2\overline{)9\text{ qt. }1\text{ pt.}}$	$4\overline{)7\text{ ft. }6\text{ in.}}$	$6\overline{)9\text{ hr. }18\text{ min.}}$
4.	$2\overline{)6\text{ lb. }4\text{ oz.}}$	$3\overline{)12\text{ lb. }8\text{ oz.}}$	$3\overline{)14\text{ hr. }10\text{ min.}}$
5.	$2\overline{)7\text{ da. }12\text{ hr.}}$	$6\overline{)12\text{ hr. }40\text{ min.}}$	$4\overline{)15\text{ gal. }2\text{ qt.}}$

Division with a Two-figure Divisor

		a	*b*	*c*	*d*
I.	1.	$12\overline{)384}$	$41\overline{)943}$	$52\overline{)1768}$	$32\overline{)1472}$
	2.	$81\overline{)4980}$	$32\overline{)745}$	$45\overline{)950}$	$53\overline{)2389}$
	3.	$92\overline{)4876}$	$44\overline{)2379}$	$61\overline{)4942}$	$64\overline{)2240}$
	4.	$34\overline{)1782}$	$25\overline{)776}$	$91\overline{)7556}$	$65\overline{)2925}$
II.	1.	$26\overline{)780}$	$43\overline{)2150}$	$23\overline{)4715}$	$27\overline{)2943}$
	2.	$42\overline{)17031}$	$35\overline{)14178}$	$35\overline{)14352}$	$21\overline{)8621}$
	3.	$75\overline{)2408}$	$67\overline{)22490}$	$56\overline{)19380}$	$42\overline{)14765}$
	4.	$13\overline{)2990}$	$21\overline{)6725}$	$25\overline{)11258}$	$60\overline{)27650}$
III.	1.	$82\overline{)3526}$	$95\overline{)7889}$	$46\overline{)1070}$	$96\overline{)5207}$
	2.	$25\overline{)2327}$	$94\overline{)9065}$	$86\overline{)8040}$	$68\overline{)6664}$
	3.	$97\overline{)9603}$	$72\overline{)66440}$	$67\overline{)65671}$	$54\overline{)5141}$
	4.	$79\overline{)78220}$	$69\overline{)67630}$	$58\overline{)56853}$	$87\overline{)84390}$

		a	*b*	*c*	*d*
IV.	1.	28)644	95)7220	56)4058	57)2584
	2.	88)6535	43)1615	23)1692	96)4643
	3.	43)3608	93)7216	25)8040	78)5680
	4.	78)5635	67)3630	58)3528	43)3608
	5.	26)8243	36)1525	48)1620	66)42905
V.	1.	38)725	79)6545	88)8272	28)744
	2.	35)2285	74)4413	49)1875	64)31243
	3.	26)2338	78)5785	68)7354	46)3718
	4.	24)1774	54)3128	27)21762	36)1426
	5.	38)2340	59)49871	35)30120	64)5037
VI.	1.	24)1842	46)2738	37)2405	26)2337
	2.	27)1728	39)1628	99)6925	84)7230
	3.	59)4032	68)3654	27)1823	29)1835
	4.	79)32092	98)7863	28)1843	88)6739
	5.	69)1237	82)8020	49)3375	46)2439
VII.	1.	14)738	16)8144	15)900	18)7243
	2.	15)7652	16)5038	17)7245	19)6358
	3.	16)4963	15)6162	19)4005	18)7562
	4.	19)14352	16)12483	15)13465	17)11256
	5.	13)10101	15)10105	16)14414	18)15820

Addition of Fractions

Part A

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*	*o*	*p*
I.	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{4}{9}$	$\frac{5}{8}$	$\frac{4}{9}$	$\frac{3}{5}$	$\frac{11}{12}$	$\frac{5}{12}$	$\frac{9}{10}$	$\frac{3}{10}$	$\frac{4}{5}$	$\frac{4}{7}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{5}{16}$
	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{7}{9}$	$\frac{7}{8}$	$\frac{4}{9}$	$\frac{4}{5}$	$\frac{7}{12}$	$\frac{11}{12}$	$\frac{7}{10}$	$\frac{7}{10}$	$\frac{4}{5}$	$\frac{6}{7}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{7}{16}$

II.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	$2\frac{1}{4}$	$3\frac{1}{8}$	$1\frac{5}{6}$	$5\frac{2}{3}$	$6\frac{7}{9}$	6	$9\frac{1}{4}$	$2\frac{3}{5}$	$\frac{5}{8}$	$9\frac{1}{4}$	$6\frac{1}{9}$
	$1\frac{1}{4}$	$\frac{7}{8}$	$4\frac{5}{6}$	$1\frac{2}{3}$	$1\frac{5}{9}$	$2\frac{3}{8}$	$\frac{3}{4}$	$\frac{4}{5}$	$2\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{8}{9}$

III.	$2\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{1}{8}$	$7\frac{2}{3}$	$9\frac{1}{6}$	$4\frac{2}{9}$	$7\frac{4}{5}$	$\frac{7}{8}$	$7\frac{1}{10}$	$6\frac{1}{4}$	$7\frac{4}{7}$
	$1\frac{1}{2}$	$1\frac{1}{4}$	5	$1\frac{2}{3}$	$2\frac{1}{6}$	$1\frac{5}{9}$	$8\frac{3}{5}$	$5\frac{1}{8}$	$3\frac{7}{10}$	9	$1\frac{6}{7}$
	3	$2\frac{3}{4}$	$4\frac{3}{8}$	8	$3\frac{5}{6}$	$3\frac{4}{9}$	$\frac{3}{5}$	$9\frac{3}{8}$	$\frac{9}{10}$	$4\frac{1}{4}$	$\frac{3}{7}$

Part B

I.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*	*o*	*p*
	$\frac{5}{6}$	$\frac{1}{6}$	$\frac{3}{4}$	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{5}{6}$	$\frac{4}{9}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{11}{12}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{5}{16}$
	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{4}{5}$	$\frac{11}{12}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{7}{16}$	$\frac{9}{16}$	$\frac{7}{8}$	$\frac{5}{8}$

II.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	$6\frac{1}{4}$	$3\frac{1}{2}$	$9\frac{1}{4}$	$7\frac{3}{5}$	$6\frac{2}{3}$	$8\frac{1}{2}$	$\frac{5}{16}$	$9\frac{1}{4}$	$\frac{4}{5}$	$8\frac{1}{2}$	$8\frac{1}{4}$
	$4\frac{1}{2}$	$2\frac{5}{6}$	$1\frac{3}{8}$	$\frac{7}{10}$	$\frac{1}{6}$	$\frac{11}{12}$	$4\frac{3}{8}$	$7\frac{7}{8}$	$1\frac{3}{10}$	$\frac{9}{16}$	$4\frac{15}{16}$

III.	$8\frac{1}{2}$	$5\frac{2}{3}$	$9\frac{3}{4}$	$\frac{5}{8}$	$9\frac{2}{3}$	$6\frac{1}{2}$	$7\frac{1}{4}$	$9\frac{2}{3}$	$7\frac{3}{4}$	$4\frac{3}{5}$	$\frac{1}{9}$
	$4\frac{1}{4}$	$1\frac{1}{6}$	$\frac{11}{12}$	$4\frac{1}{4}$	$1\frac{7}{12}$	8	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{3}{10}$	$\frac{2}{3}$
	$7\frac{3}{8}$	$2\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{6}$	$3\frac{7}{10}$	$\frac{5}{16}$	$1\frac{7}{12}$	$5\frac{1}{12}$	$8\frac{1}{2}$	4

Part C

I.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*	*o*	*p*
	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{1}{5}$	$\frac{4}{5}$	$\frac{3}{5}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{7}{8}$
	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{3}{5}$	$\frac{3}{8}$	$\frac{2}{3}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{5}{6}$

II.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	$6\frac{1}{4}$	$2\frac{1}{3}$	$7\frac{2}{3}$	$2\frac{1}{6}$	$5\frac{3}{4}$	$4\frac{1}{2}$	$9\frac{2}{5}$	$1\frac{3}{5}$	$7\frac{3}{10}$	$9\frac{2}{3}$	$5\frac{1}{6}$
	$4\frac{1}{3}$	$\frac{1}{2}$	$1\frac{3}{4}$	$\frac{1}{4}$	$9\frac{5}{6}$	$8\frac{2}{3}$	$7\frac{3}{4}$	$8\frac{1}{2}$	$4\frac{1}{4}$	$1\frac{5}{8}$	$3\frac{4}{9}$

	a	b	c	d	e	f	g	h	i	j	k
III. 1.	$2\frac{1}{2}$ $5\frac{1}{6}$ $8\frac{1}{4}$	$9\frac{1}{3}$ $3\frac{5}{6}$ $2\frac{7}{8}$	$7\frac{1}{4}$ $\frac{3}{8}$ $2\frac{5}{6}$	$\frac{4}{5}$ $\frac{1}{2}$ $5\frac{3}{4}$	$9\frac{1}{6}$ $\frac{3}{8}$ $7\frac{1}{4}$	$6\frac{2}{3}$ $\frac{5}{6}$ $3\frac{1}{4}$	$4\frac{3}{8}$ 9 $7\frac{2}{3}$	$6\frac{1}{3}$ 7 $8\frac{1}{2}$	$5\frac{3}{4}$ $\frac{1}{2}$ $7\frac{2}{3}$	$9\frac{1}{8}$ $4\frac{1}{2}$ $\frac{5}{6}$	$7\frac{4}{9}$ $2\frac{1}{2}$ $5\frac{2}{3}$
2.	$1\frac{1}{3}$ 4 $6\frac{1}{2}$	$2\frac{1}{4}$ $7\frac{2}{3}$ 8	$4\frac{5}{6}$ $2\frac{7}{9}$ $\frac{1}{2}$	$5\frac{7}{9}$ $2\frac{1}{3}$ $8\frac{1}{2}$	$6\frac{4}{5}$ $7\frac{1}{2}$ 8	4 $4\frac{2}{3}$ $5\frac{3}{4}$	$6\frac{1}{4}$ 9 $4\frac{2}{5}$	$7\frac{2}{3}$ $1\frac{4}{5}$ 6	$8\frac{1}{6}$ $6\frac{7}{8}$ $9\frac{2}{3}$	7 $5\frac{1}{2}$ $3\frac{4}{5}$	$9\frac{2}{3}$ 8 $6\frac{1}{4}$

Subtraction of Fractions

	a	b	c	d	e	f	g	h	i
I. 1.	$\frac{5}{8}$ $\frac{1}{8}$	$\frac{6}{7}$ $\frac{3}{7}$	$\frac{7}{8}$ $\frac{3}{8}$	$\frac{4}{5}$ $\frac{2}{5}$	$7\frac{5}{6}$ $3\frac{1}{6}$	$8\frac{2}{3}$ $7\frac{1}{3}$	$9\frac{5}{6}$ $7\frac{1}{6}$	$6\frac{3}{4}$ $6\frac{1}{4}$	$7\frac{2}{3}$ $\frac{2}{3}$
2.	$\frac{11}{12}$ $\frac{7}{12}$	$\frac{15}{16}$ $\frac{9}{16}$	$\frac{7}{9}$ $\frac{4}{9}$	$\frac{9}{10}$ $\frac{7}{10}$	$6\frac{5}{9}$ $1\frac{2}{9}$	$8\frac{3}{10}$ $1\frac{1}{10}$	$5\frac{7}{8}$ $1\frac{1}{8}$	$8\frac{1}{2}$ 4	$5\frac{7}{12}$ $5\frac{5}{12}$
II. 1.	6 $2\frac{3}{4}$	1 $\frac{2}{3}$	5 $\frac{3}{8}$	11 $4\frac{1}{4}$	12 $7\frac{1}{6}$	13 $4\frac{1}{8}$	12 $6\frac{2}{3}$	15 $5\frac{7}{8}$	14 $7\frac{5}{8}$
2.	7 $6\frac{1}{5}$	2 $1\frac{3}{5}$	1 $\frac{5}{6}$	18 $9\frac{7}{10}$	11 $2\frac{5}{8}$	16 $6\frac{4}{9}$	17 $7\frac{4}{5}$	16 $7\frac{9}{10}$	14 $5\frac{1}{8}$
III. 1.	$6\frac{1}{4}$ $5\frac{3}{4}$	$8\frac{1}{3}$ $4\frac{2}{3}$	$16\frac{1}{8}$ $7\frac{5}{8}$	$14\frac{1}{5}$ $6\frac{2}{5}$	$13\frac{2}{5}$ $9\frac{4}{5}$	$8\frac{1}{6}$ $7\frac{5}{6}$	$10\frac{3}{5}$ $4\frac{4}{5}$	$11\frac{1}{9}$ $2\frac{2}{9}$	$11\frac{1}{10}$ $3\frac{7}{10}$
2.	$16\frac{3}{10}$ $7\frac{9}{10}$	$15\frac{5}{8}$ $5\frac{7}{8}$	$14\frac{7}{9}$ $5\frac{8}{9}$	$15\frac{1}{3}$ $8\frac{2}{3}$	$17\frac{1}{6}$ $7\frac{5}{6}$	$16\frac{1}{12}$ $6\frac{5}{12}$	$16\frac{5}{12}$ $8\frac{7}{12}$	$17\frac{1}{12}$ $9\frac{11}{12}$	$15\frac{3}{8}$ $\frac{7}{8}$
IV. 1.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{4}{5}$ $\frac{3}{10}$	$9\frac{3}{4}$ $7\frac{1}{2}$	$8\frac{2}{3}$ $\frac{1}{6}$	$11\frac{5}{9}$ $4\frac{1}{3}$	$7\frac{5}{8}$ $\frac{1}{2}$	$1\frac{1}{4}$ $\frac{1}{8}$
2.	$\frac{9}{16}$ $\frac{1}{2}$	$\frac{7}{12}$ $\frac{1}{3}$	$\frac{4}{5}$ $\frac{3}{10}$	$\frac{5}{6}$ $\frac{1}{2}$	$9\frac{1}{3}$ $\frac{1}{6}$	$6\frac{1}{5}$ $\frac{1}{10}$	$15\frac{5}{16}$ $5\frac{1}{4}$	$16\frac{1}{2}$ $7\frac{1}{2}$	$9\frac{3}{4}$ $4\frac{7}{12}$

	a	b	c	d	e	f	g	h	i
V. 1.	$4\frac{1}{2}$	$9\frac{1}{2}$	$6\frac{1}{4}$	$7\frac{2}{3}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$11\frac{1}{4}$	$14\frac{2}{3}$	$15\frac{1}{16}$
	$1\frac{3}{4}$	$4\frac{5}{6}$	$2\frac{1}{2}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{5}{6}$	$2\frac{7}{12}$	$4\frac{11}{12}$	$7\frac{1}{2}$
2.	$8\frac{1}{10}$	$9\frac{1}{2}$	$14\frac{2}{3}$	$5\frac{1}{6}$	$9\frac{1}{16}$	$8\frac{3}{4}$	$15\frac{1}{2}$	$16\frac{1}{4}$	$17\frac{1}{4}$
	$5\frac{3}{5}$	$6\frac{7}{10}$	$\frac{11}{12}$	$4\frac{1}{3}$	$\frac{7}{8}$	$7\frac{11}{12}$	$7\frac{9}{10}$	$8\frac{1}{2}$	$7\frac{11}{12}$
VI. 1.	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{7}{8}$	$9\frac{1}{3}$	$15\frac{1}{2}$	$11\frac{3}{8}$	$8\frac{7}{9}$	$16\frac{3}{4}$
	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{6}$	$2\frac{1}{4}$	$7\frac{1}{3}$	$4\frac{1}{6}$	$2\frac{1}{6}$	$7\frac{1}{6}$
2.	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{8}{9}$	$6\frac{3}{4}$	$1\frac{5}{8}$	$14\frac{5}{9}$	$9\frac{4}{5}$	$8\frac{3}{4}$
	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{1}{6}$	$6\frac{1}{6}$	$4\frac{1}{2}$	$8\frac{2}{3}$
VII. 1.	$6\frac{1}{4}$	$7\frac{2}{3}$	$5\frac{1}{2}$	$7\frac{1}{5}$	$1\frac{3}{8}$	$4\frac{2}{3}$	$15\frac{1}{3}$	$14\frac{1}{7}$	$13\frac{1}{2}$
	$1\frac{1}{3}$	$6\frac{3}{4}$	$4\frac{2}{3}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{7}{8}$	$6\frac{5}{8}$	$5\frac{1}{2}$	$\frac{6}{7}$
2.	$1\frac{1}{4}$	$8\frac{1}{2}$	$11\frac{2}{9}$	$13\frac{1}{8}$	$14\frac{5}{8}$	$9\frac{1}{4}$	$10\frac{3}{4}$	$10\frac{5}{6}$	$14\frac{1}{3}$
	$\frac{5}{6}$	$\frac{4}{5}$	$4\frac{5}{6}$	$5\frac{2}{3}$	$7\frac{5}{6}$	$\frac{2}{3}$	$1\frac{5}{6}$	$2\frac{7}{8}$	$6\frac{4}{5}$
VIII. 1.	$\frac{1}{3}$	$6\frac{2}{3}$	$8\frac{1}{2}$	$9\frac{3}{4}$	$7\frac{5}{6}$	$1\frac{2}{3}$	$9\frac{1}{8}$	$7\frac{3}{8}$	$5\frac{4}{9}$
	$\frac{1}{3}$	$4\frac{2}{3}$	$8\frac{1}{2}$	$9\frac{1}{4}$	$\frac{5}{6}$	$\frac{2}{3}$	$9\frac{1}{8}$	$\frac{3}{8}$	$5\frac{1}{9}$

Multiplication of Fractions

	a	b	c	d	e	f
I. 1.	$4\times\frac{1}{5}$	$6\times\frac{2}{7}$	$3\times\frac{1}{8}$	$5\times\frac{4}{9}$	$7\times\frac{2}{3}$	$6\times\frac{5}{9}$
2.	$15\times\frac{1}{2}$	$9\times\frac{7}{16}$	$4\times\frac{8}{9}$	$11\times\frac{3}{4}$	$12\times\frac{8}{9}$	$10\times\frac{2}{3}$
3.	$1\times\frac{7}{8}$	$14\times\frac{5}{9}$	$10\times\frac{8}{11}$	$4\times\frac{2}{3}$	$13\times\frac{1}{2}$	$21\times\frac{7}{8}$
4.	$5\times\frac{3}{4}$	$8\times\frac{2}{3}$	$15\times\frac{3}{8}$	$7\times\frac{15}{16}$	$24\times\frac{6}{7}$	$25\times\frac{3}{8}$
II. 1.	$6\times\frac{3}{4}$	$7\times\frac{9}{14}$	$5\times\frac{9}{10}$	$16\times\frac{7}{12}$	$9\times\frac{5}{6}$	$4\times\frac{5}{6}$
2.	$2\times\frac{3}{8}$	$4\times\frac{11}{12}$	$16\times\frac{5}{8}$	$24\times\frac{5}{16}$	$36\times\frac{7}{10}$	$24\times\frac{9}{10}$
3.	$21\times\frac{3}{14}$	$9\times\frac{7}{12}$	$8\times\frac{7}{24}$	$16\times\frac{11}{12}$	$8\times\frac{1}{12}$	$22\times\frac{3}{10}$
4.	$12\times\frac{7}{8}$	$12\times\frac{9}{10}$	$15\times\frac{3}{10}$	$14\times\frac{5}{6}$	$20\times\frac{5}{6}$	$16\times\frac{1}{12}$
III. 1.	$\frac{1}{2}\times 3$	$\frac{5}{6}\times 5$	$\frac{4}{9}\times 2$	$\frac{4}{9}\times 8$	$\frac{5}{6}\times 13$	$\frac{7}{8}\times 15$
2.	$\frac{3}{5}\times 3$	$\frac{7}{8}\times 9$	$\frac{1}{8}\times 7$	$\frac{2}{3}\times 14$	$\frac{3}{4}\times 17$	$\frac{2}{3}\times 20$
3.	$\frac{9}{10}\times 7$	$\frac{5}{6}\times 1$	$\frac{3}{8}\times 17$	$\frac{3}{4}\times 19$	$\frac{5}{6}\times 35$	$\frac{3}{8}\times 11$
4.	$\frac{11}{12}\times 7$	$\frac{4}{5}\times 2$	$\frac{5}{8}\times 25$	$\frac{1}{9}\times 14$	$\frac{7}{12}\times 25$	$\frac{2}{5}\times 18$

	a	b	c	d	e	f
IV. 1.	$\frac{5}{6}\times 8$	$\frac{7}{8}\times 12$	$\frac{5}{9}\times 15$	$\frac{7}{12}\times 8$	$\frac{9}{16}\times 12$	$\frac{5}{16}\times 8$
2.	$\frac{8}{9}\times 24$	$\frac{1}{8}\times 4$	$\frac{3}{10}\times 25$	$\frac{1}{10}\times 15$	$\frac{7}{10}\times 35$	$\frac{11}{12}\times 30$
3.	$\frac{5}{16}\times 8$	$\frac{1}{16}\times 2$	$\frac{3}{16}\times 40$	$\frac{7}{10}\times 25$	$\frac{5}{8}\times 4$	$\frac{5}{6}\times 16$
4.	$\frac{3}{4}\times 14$	$\frac{5}{6}\times 20$	$\frac{5}{12}\times 50$	$\frac{8}{9}\times 30$	$\frac{1}{6}\times 9$	$\frac{3}{4}\times 22$
V. 1.	$\frac{1}{2}\times 24$	$\frac{2}{3}\times 36$	$\frac{3}{4}\times 48$	$\frac{5}{6}\times 90$	$\frac{7}{8}\times 64$	$\frac{2}{3}\times 51$
2.	$\frac{1}{3}\times 81$	$\frac{3}{4}\times 96$	$\frac{7}{12}\times 84$	$\frac{5}{6}\times 120$	$\frac{4}{9}\times 36$	$\frac{7}{12}\times 168$
3.	$\frac{4}{5}\times 80$	$\frac{9}{10}\times 80$	$\frac{5}{6}\times 360$	$\frac{7}{9}\times 180$	$\frac{3}{8}\times 240$	$\frac{5}{16}\times 80$
4.	$\frac{7}{9}\times 63$	$\frac{9}{10}\times 50$	$\frac{3}{4}\times 720$	$\frac{1}{8}\times 120$	$\frac{11}{16}\times 96$	$\frac{6}{7}\times 84$
VI. 1.	$\frac{1}{2}\times\frac{1}{3}$	$\frac{2}{3}\times\frac{1}{5}$	$\frac{4}{5}\times\frac{7}{9}$	$\frac{1}{3}\times\frac{5}{8}$	$\frac{5}{6}\times\frac{1}{2}$	$\frac{11}{12}\times\frac{5}{8}$
2.	$\frac{6}{7}\times\frac{1}{5}$	$\frac{3}{4}\times\frac{3}{8}$	$\frac{1}{2}\times\frac{7}{16}$	$\frac{3}{4}\times\frac{3}{8}$	$\frac{1}{2}\times\frac{1}{8}$	$\frac{3}{8}\times\frac{1}{5}$
3.	$\frac{1}{4}\times\frac{1}{2}$	$\frac{3}{4}\times\frac{1}{2}$	$\frac{5}{6}\times\frac{7}{9}$	$\frac{3}{8}\times\frac{1}{16}$	$\frac{3}{4}\times\frac{1}{16}$	$\frac{3}{4}\times\frac{7}{16}$
4.	$\frac{1}{3}\times\frac{1}{4}$	$\frac{5}{8}\times\frac{7}{9}$	$\frac{7}{9}\times\frac{3}{4}$	$\frac{2}{3}\times\frac{8}{9}$	$\frac{7}{8}\times\frac{3}{4}$	$\frac{7}{8}\times\frac{5}{12}$
VII. 1.	$\frac{7}{8}\times\frac{8}{9}$	$\frac{5}{6}\times\frac{2}{3}$	$\frac{3}{4}\times\frac{2}{3}$	$\frac{1}{9}\times\frac{3}{8}$	$\frac{7}{8}\times\frac{6}{7}$	$\frac{1}{2}\times\frac{4}{5}$
2.	$\frac{3}{4}\times\frac{11}{12}$	$\frac{8}{9}\times\frac{5}{6}$	$\frac{4}{9}\times\frac{3}{4}$	$\frac{7}{12}\times\frac{8}{9}$	$\frac{3}{4}\times\frac{1}{12}$	$\frac{5}{6}\times\frac{9}{10}$
3.	$\frac{1}{2}\times\frac{8}{9}$	$\frac{1}{4}\times\frac{8}{11}$	$\frac{3}{5}\times\frac{10}{11}$	$\frac{9}{16}\times\frac{2}{3}$	$\frac{11}{16}\times\frac{8}{9}$	$\frac{4}{7}\times\frac{3}{4}$
4.	$\frac{1}{3}\times\frac{9}{10}$	$\frac{2}{3}\times\frac{5}{8}$	$\frac{3}{8}\times\frac{5}{9}$	$\frac{7}{10}\times\frac{5}{7}$	$\frac{7}{10}\times\frac{5}{14}$	$\frac{11}{12}\times\frac{9}{10}$

VIII.	a	b	c	d	e
1.	$1\frac{1}{2}\times 4\frac{2}{3}$	$6\frac{1}{4}\times 2\frac{1}{2}$	$6\times 1\frac{2}{3}$	$4\frac{2}{3}\times\frac{8}{9}$	$4\frac{7}{8}\times\frac{1}{2}$
2.	$\frac{4}{5}\times 8\frac{1}{2}$	$7\frac{1}{3}\times\frac{1}{2}$	$9\frac{3}{8}\times 1\frac{1}{4}$	$6\frac{1}{3}\times 4\frac{5}{6}$	$\frac{3}{4}\times 8\frac{2}{3}$
3.	$14\frac{2}{3}\times\frac{8}{11}$	$9\frac{1}{3}\times 1\frac{1}{2}$	$5\frac{2}{3}\times 6\frac{3}{4}$	$\frac{1}{8}\times 4\frac{4}{5}$	$\frac{2}{3}\times 4\frac{1}{2}$
4.	$4\frac{1}{4}\times\frac{2}{3}$	$9\frac{1}{6}\times 3\frac{1}{7}$	$\frac{5}{6}\times 4\frac{1}{5}$	$7\frac{1}{2}\times 5\frac{2}{3}$	$8\frac{1}{2}\times 1\frac{1}{4}$

IX.	a	b	c	d	e	f	g	h	i
1.	14 $6\frac{1}{2}$	24 $5\frac{3}{6}$	$36\frac{1}{2}$ 8	$23\frac{3}{4}$ 6	$15\frac{1}{8}$ 3	$26\frac{1}{6}$ 5	$17\frac{2}{3}$ 8	16 $4\frac{1}{3}$	31 $2\frac{1}{2}$
2.	36 $8\frac{1}{4}$	17 $2\frac{3}{4}$	72 $4\frac{5}{6}$	21 $4\frac{2}{3}$	50 $8\frac{5}{6}$	$14\frac{7}{8}$ 6	$37\frac{1}{2}$ 9	$50\frac{1}{4}$ 9	$18\frac{3}{4}$ 7
3.	9 $2\frac{3}{8}$	37 $4\frac{3}{4}$	28 $3\frac{7}{8}$	64 $5\frac{2}{3}$	$9\frac{3}{8}$ 6	$12\frac{1}{2}$ 7	$22\frac{2}{3}$ 5	$14\frac{3}{8}$ 7	$35\frac{1}{4}$ 6
4.	$15\frac{3}{4}$ 8	$27\frac{1}{2}$ 6	$19\frac{2}{3}$ 9	$26\frac{3}{8}$ 7	34 $2\frac{3}{4}$	56 $6\frac{7}{8}$	39 $7\frac{2}{3}$	45 $8\frac{3}{4}$	72 $7\frac{8}{9}$

Division of Fractions

		a	*b*	*c*	*d*	*e*
I.	**1.**	$\frac{3}{4} \div 3$	$\frac{7}{8} \div 2$	$\frac{5}{6} \div 3$	$\frac{8}{9} \div 4$	$\frac{3}{4} \div 2$
	2.	$\frac{9}{10} \div 3$	$\frac{6}{7} \div 4$	$\frac{7}{8} \div 3$	$\frac{1}{3} \div 2$	$\frac{7}{12} \div 7$
	3.	$\frac{10}{11} \div 5$	$\frac{9}{16} \div 3$	$\frac{7}{16} \div 4$	$\frac{3}{8} \div 6$	$\frac{9}{10} \div 6$
	4.	$\frac{5}{6} \div 5$	$\frac{1}{2} \div 3$	$\frac{8}{9} \div 6$	$\frac{6}{7} \div 3$	$\frac{15}{16} \div 5$
II.	**1.**	$1\frac{1}{2} \div 3$	$4\frac{1}{2} \div 3$	$6\frac{1}{2} \div 3$	$8\frac{1}{4} \div 5$	$1\frac{2}{3} \div 5$
	2.	$8\frac{2}{3} \div 4$	$12\frac{1}{2} \div 5$	$5\frac{1}{4} \div 7$	$3\frac{1}{7} \div 2$	$8\frac{1}{2} \div 6$
	3.	$1\frac{1}{9} \div 5$	$4\frac{2}{3} \div 7$	$1\frac{1}{8} \div 3$	$2\frac{1}{6} \div 2$	$4\frac{3}{4} \div 5$
	4.	$1\frac{1}{4} \div 5$	$2\frac{1}{2} \div 6$	$15\frac{2}{3} \div 3$	$11\frac{1}{3} \div 4$	$9\frac{1}{3} \div 4$
III.	**1.**	$9 \div \frac{1}{2}$	$12 \div \frac{3}{4}$	$72 \div \frac{2}{3}$	$36 \div \frac{4}{9}$	$48 \div \frac{4}{5}$
	2.	$24 \div \frac{6}{7}$	$81 \div \frac{3}{5}$	$32 \div \frac{4}{7}$	$13 \div \frac{1}{3}$	$28 \div \frac{2}{3}$
	3.	$30 \div \frac{2}{3}$	$45 \div \frac{9}{10}$	$80 \div \frac{4}{5}$	$16 \div \frac{2}{3}$	$57 \div \frac{3}{5}$
	4.	$72 \div \frac{3}{8}$	$12 \div \frac{3}{8}$	$45 \div \frac{5}{9}$	$16 \div \frac{4}{5}$	$120 \div \frac{5}{6}$
IV.	**1.**	$8 \div \frac{5}{6}$	$7 \div \frac{2}{3}$	$14 \div \frac{4}{5}$	$16 \div \frac{7}{8}$	$15 \div \frac{9}{10}$
	2.	$1 \div \frac{7}{8}$	$2 \div \frac{3}{4}$	$6 \div \frac{9}{10}$	$15 \div \frac{4}{9}$	$24 \div \frac{5}{6}$
	3.	$4 \div \frac{8}{9}$	$6 \div \frac{4}{5}$	$13 \div \frac{2}{3}$	$9 \div \frac{6}{7}$	$14 \div \frac{3}{8}$
	4.	$16 \div \frac{10}{11}$	$9 \div \frac{5}{6}$	$14 \div \frac{6}{7}$	$12 \div \frac{15}{16}$	$25 \div \frac{4}{5}$
V.	**1.**	$6 \div 2\frac{1}{2}$	$5 \div 2\frac{1}{2}$	$9 \div 3\frac{1}{4}$	$8 \div 4\frac{1}{6}$	$12 \div 2\frac{1}{2}$
	2.	$12 \div 8\frac{1}{4}$	$16 \div 1\frac{3}{4}$	$14 \div 1\frac{3}{4}$	$10 \div 8\frac{1}{3}$	$30 \div 3\frac{1}{3}$
	3.	$2 \div 2\frac{1}{2}$	$3 \div 2\frac{1}{4}$	$6 \div 8\frac{1}{2}$	$2 \div 4\frac{1}{4}$	$12 \div 8\frac{2}{3}$
	4.	$6 \div 1\frac{7}{8}$	$9 \div 1\frac{1}{6}$	$25 \div 1\frac{7}{8}$	$1 \div 2\frac{1}{2}$	$18 \div 3\frac{1}{7}$
VI.	**1.**	$\frac{1}{2} \div \frac{1}{4}$	$\frac{1}{4} \div \frac{1}{2}$	$\frac{5}{6} \div \frac{5}{6}$	$\frac{3}{4} \div \frac{7}{8}$	$\frac{2}{3} \div \frac{5}{6}$
	2.	$\frac{3}{4} \div \frac{3}{4}$	$\frac{7}{8} \div \frac{3}{4}$	$\frac{2}{3} \div \frac{5}{8}$	$\frac{5}{6} \div \frac{3}{5}$	$\frac{1}{2} \div \frac{2}{3}$
	3.	$\frac{3}{8} \div \frac{6}{7}$	$\frac{6}{7} \div \frac{3}{8}$	$\frac{1}{2} \div \frac{7}{8}$	$\frac{7}{8} \div \frac{1}{2}$	$\frac{11}{12} \div \frac{1}{3}$
	4.	$\frac{9}{10} \div \frac{3}{4}$	$\frac{3}{4} \div \frac{9}{10}$	$\frac{1}{5} \div \frac{4}{5}$	$\frac{4}{5} \div \frac{1}{5}$	$\frac{5}{8} \div \frac{5}{9}$
	5.	$\frac{1}{2} \div \frac{1}{9}$	$\frac{1}{9} \div \frac{1}{2}$	$\frac{4}{5} \div \frac{2}{5}$	$\frac{2}{5} \div \frac{4}{5}$	$\frac{8}{9} \div \frac{3}{4}$

VII.		*a*	*b*	*c*	*d*	*e*
	1.	$2\frac{1}{2} \div 1\frac{1}{3}$	$1\frac{1}{3} \div 2\frac{1}{2}$	$4\frac{1}{2} \div 2\frac{1}{4}$	$2\frac{1}{4} \div 4\frac{1}{2}$	$9\frac{1}{2} \div 3\frac{1}{3}$
	2.	$8\frac{1}{2} \div 1\frac{1}{4}$	$1\frac{1}{4} \div 8\frac{1}{2}$	$2\frac{5}{6} \div 3\frac{1}{3}$	$3\frac{1}{3} \div 2\frac{5}{6}$	$4\frac{5}{12} \div 2\frac{5}{6}$
	3.	$4\frac{3}{4} \div 4\frac{1}{4}$	$2\frac{5}{6} \div 2\frac{1}{2}$	$2\frac{1}{2} \div 2\frac{5}{6}$	$8\frac{3}{4} \div 2\frac{1}{4}$	$2\frac{1}{5} \div 3\frac{2}{3}$
	4.	$1\frac{1}{4} \div 1\frac{1}{2}$	$4\frac{1}{4} \div 4\frac{3}{4}$	$3\frac{2}{3} \div 2\frac{1}{5}$	$3\frac{1}{7} \div 4\frac{2}{5}$	$4\frac{2}{5} \div 3\frac{1}{7}$

		a	b	c	d	e
VIII.	1.	$1\frac{2}{3} \div \frac{2}{3}$	$1\frac{1}{2} \div \frac{1}{2}$	$\frac{1}{2} \div 1\frac{1}{2}$	$\frac{1}{2} \div 2\frac{1}{2}$	$8\frac{1}{4} \div \frac{3}{4}$
	2.	$\frac{1}{4} \div 2\frac{1}{2}$	$\frac{5}{8} \div 3\frac{1}{4}$	$3\frac{1}{4} \div \frac{5}{8}$	$9\frac{1}{2} \div \frac{1}{2}$	$\frac{1}{2} \div 9\frac{1}{2}$
	3.	$\frac{3}{8} \div 4\frac{1}{4}$	$\frac{7}{8} \div 3\frac{3}{4}$	$9\frac{1}{6} \div 2\frac{1}{2}$	$\frac{9}{16} \div 3\frac{1}{3}$	$3\frac{1}{3} \div \frac{9}{16}$
	4.	$\frac{5}{6} \div 1\frac{3}{4}$	$9\frac{1}{4} \div \frac{3}{4}$	$8\frac{1}{4} \div \frac{1}{4}$	$\frac{1}{4} \div 8\frac{1}{4}$	$\frac{6}{7} \div 3\frac{1}{3}$

Addition of Decimals

I.	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	.3	.4	.6	.2	.5	.1	.2	.5	.1	.9	.7	.9	.4	.6
	.5	.7	.6	.4	.7	.3	.7	.4	.2	.9	.8	.3	.5	.3
	.9	.2	.3	.8	.6	.9	.8	.1	.4	.4	.5	.5	.7	.2

II.	a	b	c	d	e	f	g	h	i
1.	5.4	17.2	3.7	6.8	4.2	25.5	64.3	5.1	6.2
	3.8	9.8	4.4	12.7	5.1	4.9	18.5	7.8	27.7
	9.6	5.6	0.9	3.9	7.6	7.2	9.6	3.4	9.5
2.	4.5	21.2	1.4	17.0	11.6	0.8	24.5	2.2	14.7
	0.6	18.5	14.6	3.9	5.9	1.7	9.6	0.6	15.5
	3.7	16.7	5.3	5.8	7.6	0.4	3.8	5.8	3.6

III.	a	b	c	d	e	f	g	h	i	j	k
	.26	.96	.70	.05	.75	.25	.65	.41	.55	.97	.35
	.38	.18	.40	.04	.38	.75	.78	.46	.48	.14	.54
	.54	.23	.60	.08	.41	.50	.39	.37	.54	.35	.26

IV.	a	b	c	d	e	f	g	h
	2.75	1.90	0.48	3.45	27.50	7.45	0.45	6.57
	3.80	2.58	9.53	1.78	9.60	24.78	14.26	23.46
	5.67	1.67	14.29	4.60	3.80	9.36	11.35	9.18

V.	.436	.325	.967	.140	.385	.475	.256	.721
	.295	.745	.358	.360	.196	.186	.873	.385
	.160	.480	.225	.290	.750	.399	.435	.967

		a	b	c	d	e	f	g	h
VI.	1.	4.325	0.468	0.354	9.250	0.723	4.260	0.995	0.358
		0.928	1.318	0.726	1.480	1.396	3.980	0.496	12.729
		0.560	0.296	3.005	0.375	0.587	0.167	1.002	4.165
	2.	4.325	0.355	5.647	2.480	0.005	0.125	7.310	2.007
		1.004	0.128	0.908	1.960	0.016	0.248	0.480	0.396
		0.160	4.009	1.235	0.380	1.000	1.300	0.005	0.145

VII.		a	b	c
	1.	.6 + .85 + .72	.76 + .9 + .7	.125 + .38 + .16
	2.	.36 + .79 + .1	.1 + .15 + .35	.450 + .237 + .09
	3.	.9 + .09 + .27	.5 + .45 + .1	.375 + .75 + .25
	4.	.78 + .1 + .55	.15 + .3 + .69	.146 + .93 + .7

Subtraction of Decimals

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
I.	.9	.6	.4	.8	.7	.9	.5	.9	.8	.6	.3	.7	.7	.3	.8
	.3	.5	.3	.5	.2	.5	.1	.1	.6	.4	.3	.4	.6	.2	.1

		a	b	c	d	e	f	g	h	i
II.		7.4	5.0	9.6	8.7	2.1	6.5	11.3	14.6	27.4
		3.2	4.6	3.8	4.7	1.9	4.6	5.8	2.7	13.9
III.		.46	.52	.70	.19	.18	.06	.08	.23	.47
		.13	.48	.36	.09	.09	.03	.01	.15	.18
IV.		13.25	5.48	3.10	1.80	14.85	11.45	5.04	7.20	5.01
		1.45	0.29	2.90	0.95	0.65	9.20	3.86	6.38	4.90
V.	1.	.675	.380	.020	.009	.845	.915	.742	.411	.603
		.295	.365	.008	.007	.738	.886	.358	.402	.504
	2.	.041	.700	.060	.344	.748	.100	.532	.624	.889
		.018	.560	.006	.164	.658	.010	.433	.524	.498

VI.		a	b	c	d	e	f
	1.	3.478	6.100	7.348	15.231	8.372	6.005
		1.927	0.925	2.484	9.255	1.372	0.005
	2.	12.050	28.725	23.171	25.000	34.120	9.624
		8.068	14.945	16.172	12.005	0.540	3.724

VII.		a	b	c	d
	1.	9.35 − 4.6	7.3 − 2.58	5 − 4.3	7.2 − 1.65
	2.	16 − 3.8	11.1 − 4.72	3.58 − 2.5	9.6 − 4.25
	3.	7.36 − 1.8	6.7 − 3.07	14.1 − 8.41	15.2 − 13.8
	4.	6 − 5.9	27 − 9.8	11.5 − 3.56	17.56 − 8

Multiplication of Decimals

I.		a	b	c	d	e	f	g	h	i	j
	1.	.6	.75	3.7	2.9	.46	1.5	.57	.925	3.68	.861
		4	2	8	5	7	6	8	8	4	7
	2.	.542	.103	7.28	.57	.9	.48	.192	.105	.604	.837
		9	6	2	7	9	3	3	5	4	9
II.	1.	36	54	93	59	75	32	68	93	86	72
		.6	.7	.8	.2	.8	.17	.24	2.5	5.2	6.9
	2.	8	14	38	56	47	65	31	84	96	54
		.6	1.4	1.2	.91	2.8	2.5	1.1	.25	.8	5.1
III.	1.	2.6	7.5	3.61	9.2	7.5	12.3	9.75	4.6	15.7	42.1
		.3	.9	.4	.8	.5	.9	.3	.7	.4	.8
	2.	9.2	3.4	6.8	4.75	1.05	7.08	2.8	13.2	26.8	7.8
		.7	.5	.1	.6	.5	.8	.5	.2	.9	.4

		a	b	c	d	e	f	g	h
IV.	1.	.7	.4	.37	.15	.28	.72	.16	.46
		.5	.4	.3	.6	.4	.9	.5	.12

	a	b	c	d	e	f	g	h
2.	.4	.38	.19	.25	.51	.63	.75	.65
	.9	.3	.7	.4	.9	.2	.4	.8
V. 1.	.3	.5	.2	.05	.08	.1	.01	.3
	.2	.1	.2	.6	.8	.1	.1	.3
2.	.02	.03	.05	.16	.48	.18	.17	.16
	.3	.2	.5	.3	.2	.5	.4	.6
VI. 1.	.325	.715	.135	.056	.325	.478	.936	.105
	.2	.1	.4	.7	.09	.08	.1	.4
2.	.025	.019	.034	.056	.941	.856	.037	.012
	.02	.01	.7	.8	.05	.07	.3	.8
VII. 1.	.342	2.18	3.68	.925	.527	.183	.695	.025
	2.5	.015	.07	3.8	4.6	.54	3.1	.35
2.	6.38	.547	8.51	9.54	3.48	.163	91.3	16.7
	.04	.01	.06	1.7	.08	.02	.07	.04
VIII. 1.	4.8	.562	32.9	.736	5.247	42.16	.967	.34
	10	100	100	10	1000	1000	10	10
2.	.039	.056	.1754	39.2	.0213	13.15	5.41	682.8
	10	100	1000	100	1000	1000	10	1000

Division of Decimals

I.	a	b	c	d	e
1.	7)14.7	3)9.6	17).51	9)4.68	7)38.5
2.	11)1.87	16)9.12	5)1.75	3)29.7	15)2.55
II. 1.	3).144	8)1.2	9).288	4)1.8	7).294
2.	15).105	16).8	34).17	96).24	36).9
3.	3).228	7)3.01	2).1	4).3	8).12

		a	*b*	*c*	*d*	*e*
III.	1.	$.3\overline{)7.2}$	$.5\overline{).95}$	$1.4\overline{).98}$	$.36\overline{).108}$	$2.3\overline{)1.61}$
	2.	$.4\overline{)9.6}$	$1.3\overline{).91}$	$.16\overline{).064}$	$.45\overline{).2025}$	$.9\overline{)7.56}$
	3.	$2.9\overline{)8.7}$	$2.1\overline{).672}$	$.26\overline{).0234}$	$.15\overline{).0225}$	$.7\overline{).441}$
IV.	1.	$.2\overline{)3.1}$	$.5\overline{).98}$	$.8\overline{)1.2}$	$.4\overline{).14}$	$.16\overline{)5.6}$
	2.	$2.5\overline{).8}$	$.25\overline{).1}$	$7.5\overline{).3}$	$3.2\overline{).16}$	$.24\overline{)1.8}$
	3.	$5.6\overline{).14}$	$7.2\overline{).36}$	$.72\overline{).018}$	$4.8\overline{).72}$	$2.5\overline{).3}$
V.	1.	$.03\overline{).78}$	$.02\overline{)9.6}$	$.13\overline{)9.1}$	$.16\overline{)8.4}$	$.21\overline{)14.7}$
	2.	$.05\overline{)4.8}$	$.06\overline{)7.2}$	$.12\overline{)8.4}$	$.24\overline{)57.6}$	$.08\overline{)12.8}$
VI.	1.	$4\overline{)1}$	$5\overline{)2}$	$8\overline{)1}$	$16\overline{)4}$	$12\overline{)9}$
	2.	$2\overline{)1}$	$24\overline{)6}$	$36\overline{)27}$	$96\overline{)72}$	$5\overline{)4}$
	3.	$50\overline{)8}$	$60\overline{)15}$	$25\overline{)7}$	$75\overline{)3}$	$5\overline{)1}$
VII.	1.	$3\overline{)2}$	$3\overline{)8}$	$12\overline{)7}$	$6\overline{)5}$	$9\overline{)5}$
	2.	$9\overline{)4}$	$11\overline{)5}$	$12\overline{)11}$	$14\overline{)9}$	$24\overline{)17}$
	3.	$6\overline{)74}$	$23\overline{)96}$	$9\overline{)11}$	$7\overline{)37}$	$12\overline{)10}$
VIII.	1.	$.02\overline{)1}$	$.04\overline{)3}$	$.16\overline{)5}$	$.24\overline{)6}$	$.05\overline{)4}$
	2.	$.08\overline{)3}$	$.04\overline{)2}$	$.12\overline{)6}$	$.38\overline{)19}$	$.15\overline{)6}$

IX.		*a*	*b*	*c*	*d*
	1.	$\begin{array}{r}35\\12.5\overline{)4375}\end{array}$	$\begin{array}{r}35\\125\overline{)4.375}\end{array}$	$\begin{array}{r}35\\1.25\overline{)4.375}\end{array}$	$\begin{array}{r}35\\.125\overline{)43.75}\end{array}$
	2.	$\begin{array}{r}35\\.125\overline{)4375}\end{array}$	$\begin{array}{r}35\\1.25\overline{)43.75}\end{array}$	$\begin{array}{r}35\\.125\overline{).04375}\end{array}$	$\begin{array}{r}35\\1.25\overline{).04375}\end{array}$
	3.	$\begin{array}{r}35\\12.5\overline{).4375}\end{array}$	$\begin{array}{r}35\\125\overline{)43.75}\end{array}$	$\begin{array}{r}35\\125\overline{).4375}\end{array}$	$\begin{array}{r}35\\12.5\overline{).04375}\end{array}$
	4.	$\begin{array}{r}35\\12.5\overline{)43.75}\end{array}$	$\begin{array}{r}35\\1.25\overline{).4375}\end{array}$	$\begin{array}{r}35\\125\overline{)437.5}\end{array}$	$\begin{array}{r}35\\.125\overline{)437.5}\end{array}$

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